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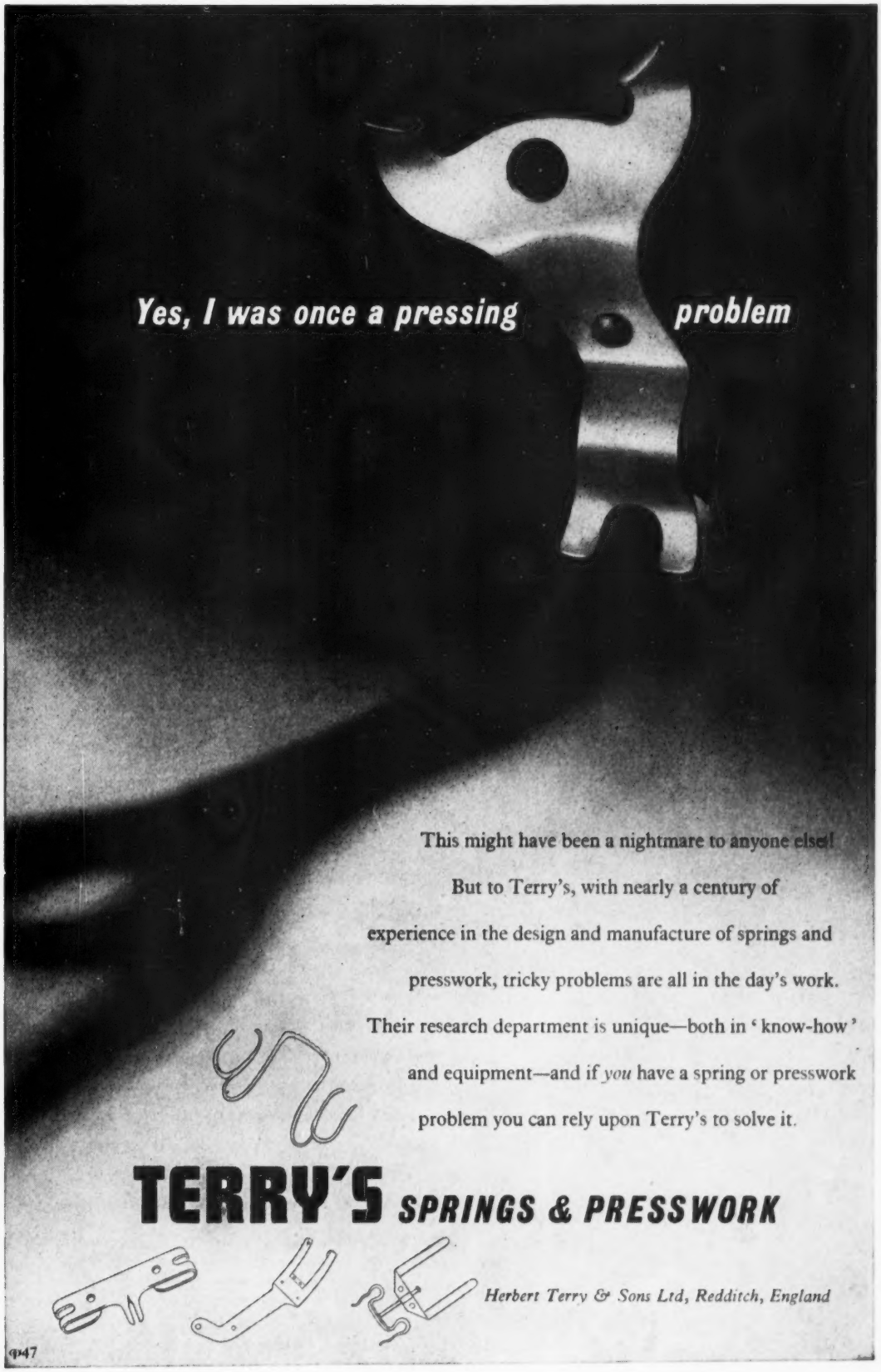
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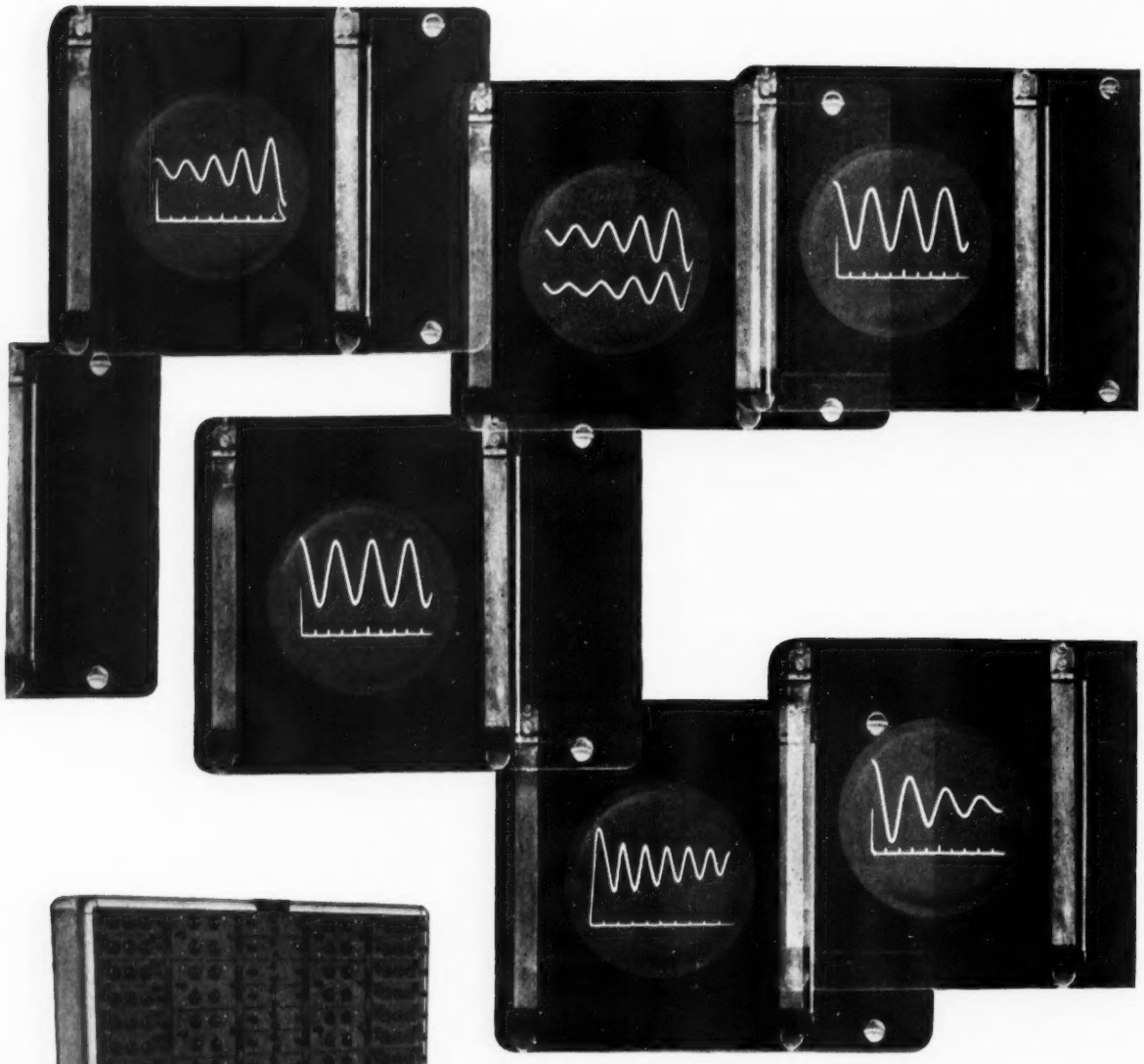

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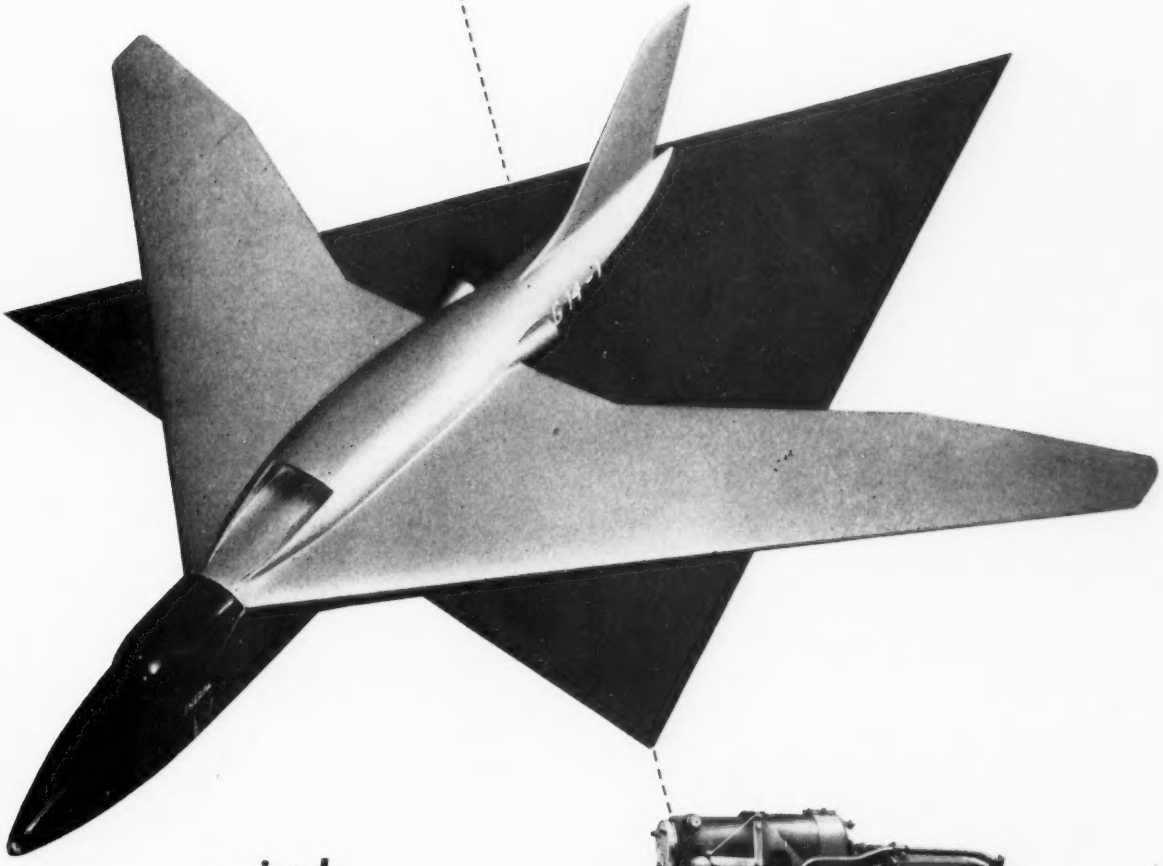

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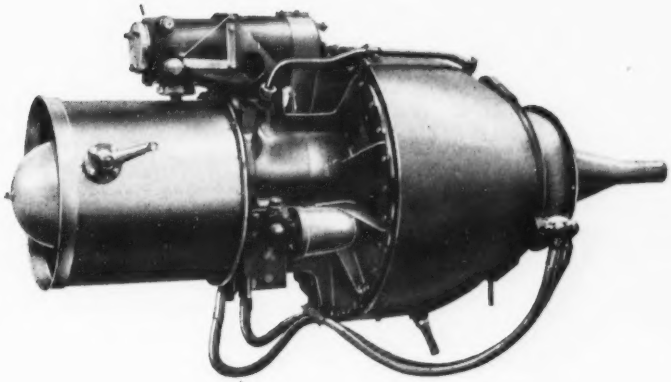

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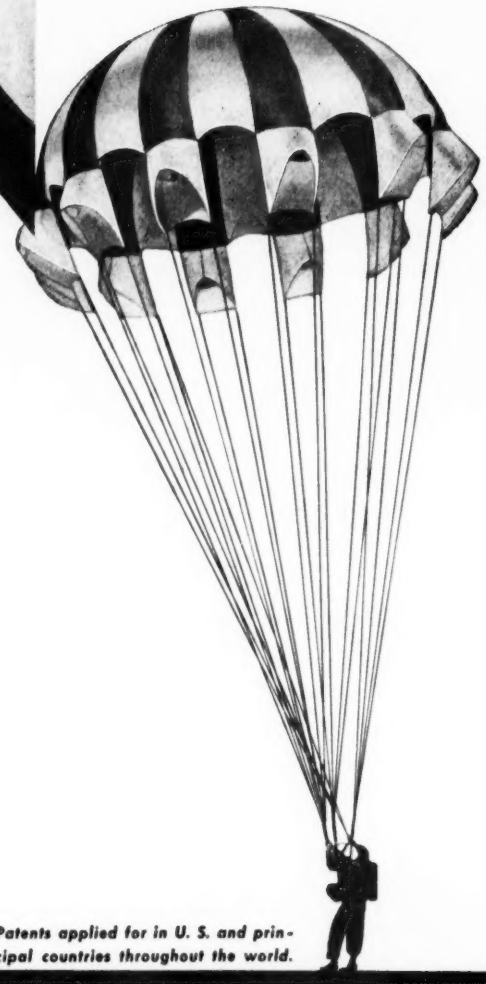

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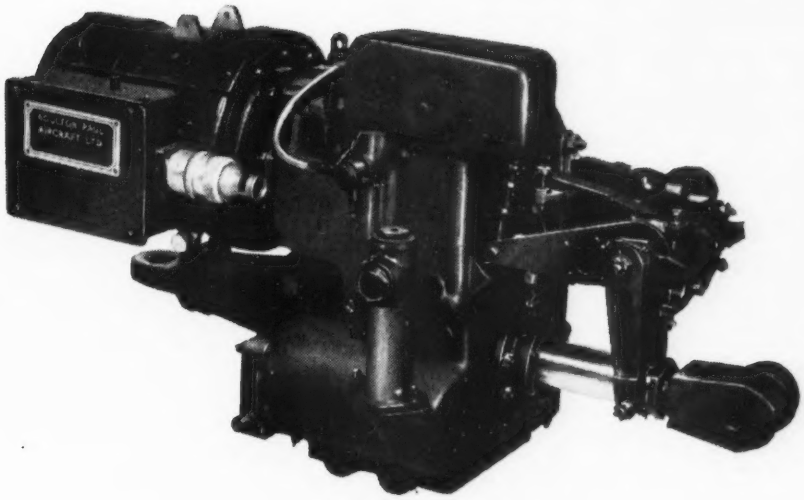

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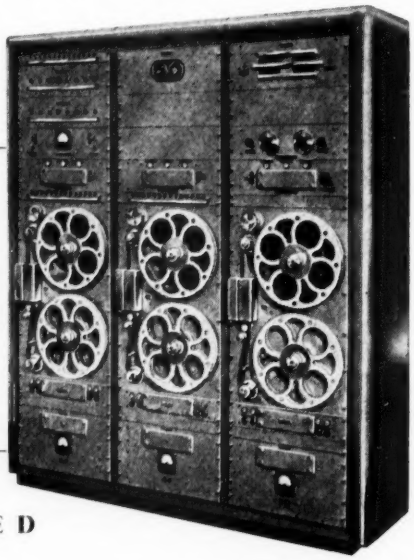

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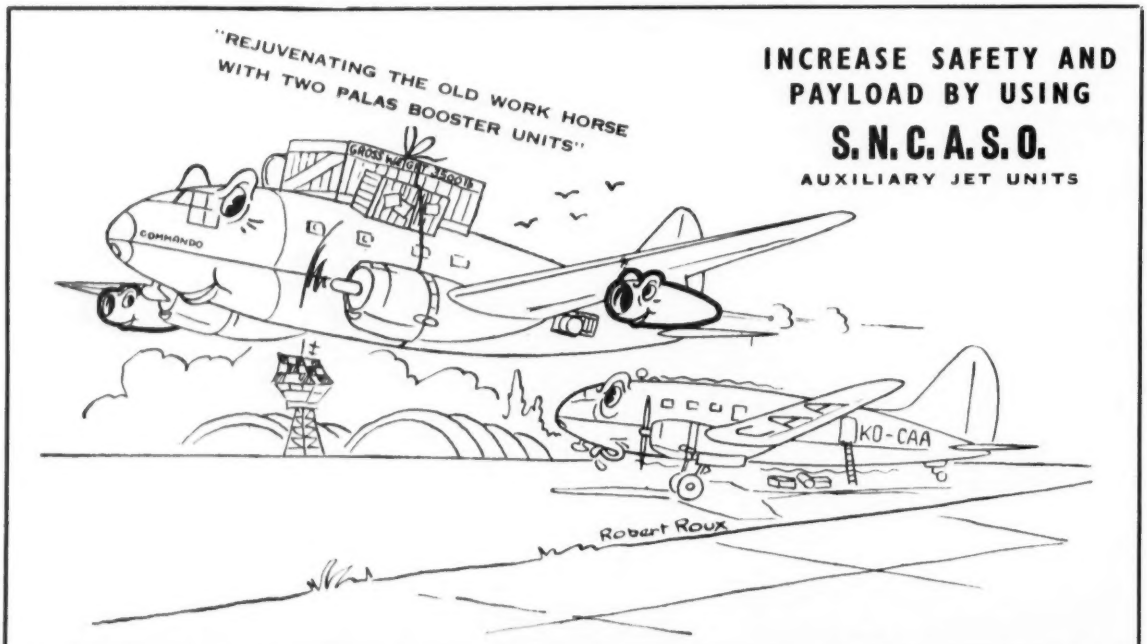

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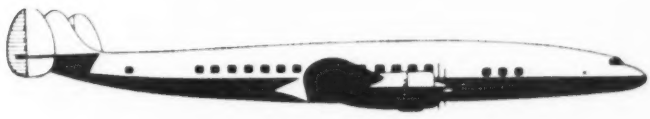

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No. 2331 Vol. LXIV. FRIDAY, 25 SEPTEMBER 1953

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Editorial, Advertising and Publishing Offices:

DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

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Air Port of London

TO an increasing proportion of international travellers, an airport is the first close-up view of a new land. Last year, for instance, more people arrived in Britain *via* the runways of London and Northolt Airports than by way of the traditional white cliffs and harbour of Dover. It follows that a terminal building must not only be designed to permit a smooth and rapid flow through immigration, customs and reception formalities, but that its appearance should make an appropriate impression on the visitor.

To some extent, the architecture of a major airport will reflect national characteristics and outlook. So far Britain has remained behind many nations, on both sides of the Atlantic, in erecting such buildings, despite the pre-eminence of this country as a link in the chain of world air travel. In a sense, however, our present lack of permanent buildings expresses British determination to do things in the right order and to do them well.

This apparent tardiness has in fact given certain advantages to those responsible for planning our key airport. It has enabled them better to assess the probable future trend of traffic-growth, so that the new terminal should be neither hopelessly small and crowded nor a vast, empty symbol of the optimism which, at one early post-war stage, resulted in wasteful construction abroad. And the limited amount of public money available for airport development has been spent in the most logical sequence; aeronautically, London Airport is second to none, and compares well with foreign rivals which may have magnificent concrete buildings but inadequate runways and aids.

Plans have now been announced, as related on pages 432-433, for providing London with permanent airport buildings of impressive design and capacity. No one will regret the consequent abandonment of the present hutted terminal alongside the Bath Road—leaving space, perhaps, for construction of an airport hotel which might add the finishing touch to the ambitious plans already made for the airport's buildings.

With the latest in turbine airliners in service, fine runways laid and, in hand, buildings and equipment worthy of London, there remains one more problem to be tackled—that of expediting the land journey to and from the airport.

Anglo-American Accord

TECHNICAL interest passed from the airfield to the lecture hall last week, when the Industry's Show closed after its fourteenth and record year—record for attendance, for firm orders placed, and for good flying weather. On the Monday it seemed as if every one of the S.B.A.C.'s guests as well as the members of the Institute of the Aeronautical Sciences had been squeezed into No. 4 Hamilton Place for the Royal Aeronautical Society's reception for delegates at the Fourth Anglo-American Conference. Attendance at the dozen excellent lectures during the next three days was also heavy, amounting on average to some three hundred delegates; and there was no doubt that the quality of the papers that were read, and the discussions which followed them, was the highest yet achieved. This was indicative of increasingly good understanding no longer confined to a few British and American technicians.

The culminating dinner-dance—a quite delightful social occasion—was held at the Dorchester Hotel in London. After Sir William Farren, president of the R.Ae.S., had warmly toasted the Institute of the Aeronautical Sciences, Mr. C. J. McCarthy, his opposite number, stated forthrightly that this fourth Conference had been the best.

Delegates to past Conferences had noted a reluctance on the part of many American technicians to enter freely into the post-lecture discussions, but this year the position was quite different and the symposium benefited accordingly. There was deserved applause for the work of Dr. Ballantyne (secretary of the R.Ae.S. and organizer of the proceedings) and his staff in making, as Mr. McCarthy put it, a complicated task look easy.

In a message which he addressed to the Conference, President Eisenhower drew attention to the international importance of such an occasion. To the individuals who during the last week or two have been transformed from the technical vice-president of X Aircraft Corporation or the chief designer of Y Aviation Co., to Mac, Joe and Ernie, this fourth Conference has represented a much more personal form of co-operation and contact which must prove invaluable in the future.

FROM ALL QUARTERS

FASTEST BY THE WATCH: World speed record claimant, the red Hawker Hunter with Rolls-Royce Avon turbojet, has now added the 100-km closed-circuit record to its bag. Below are seen S/L. Neville Duke, the pilot (he is Hawker's chief test pilot) and on his right, Sir Sydney Camm, chief designer of Hawker Aircraft Ltd.

New Closed-circuit Record for the Hunter

LAST Saturday S/L. Neville Duke gained for Britain another world speed record—that for the 100-km closed circuit—with a speed, subject to confirmation, of 709.2 m.p.h. He was flying the same red Hunter powered by an Avon engine with re-heat in which he recently established a world's speed record. The new record is 19.082 m.p.h. faster than the previous one—still to be confirmed—of 690.118 m.p.h., held by Brigadier-General J. S. Holtoner. The official record is still held by Miss Jacqueline Cochran who, in a Sabre F-86E0, achieved a speed of 652.55 m.p.h. It is all the more remarkable since weather conditions at the time were far from ideal, the temperature being lower than 60 deg F with some rain, low cloud, and bad light. The previous record had been set up during the heat wave in America at the beginning of this month.

The course began and ended at Dunsfold, and entailed a 25-mile straight outward leg, followed by a 12-mile turn and a 25-mile straight leg home. It was marked by 15 bell tents, in each of which observers were stationed, with Verey lights and candle markers. These were fired continuously to give the pilot a track guide. Immediately after the Hunter had passed, a Hurricane flew round the course to observe pre-arranged signals displayed at each tent. One white board indicated that the marker had not been infringed by the record aircraft, and two white boards would have indicated an infringement. In fact, no infringement occurred. The timing was carried out by a system of cameras interlinked with automatic electric clocks.

In all important respects the red Hunter registered WB188 is a standard machine, although such features as the pointed nose and rounded windscreen are not found in production aircraft.

This 100-km record, while it may not capture the popular imagination as does the maximum air speed record is, in fact, more significant from the point of view of a fighter aircraft ordered for the R.A.F. The chief designer is, of course, Sir Sydney Camm, to whom great credit is due, together with Neville Duke the pilot.

The Swift Speed Record Attempt

EARLY this week preparations were under way for another attack on the world's speed record—by a Supermarine Swift F.4 with Rolls-Royce Avon of unspecified mark but equipped with reheat. It is possible that this new effort, with Mike Lithgow at the controls, will have met with success by the time these words are read. He set off in his blue Swift from Chibolton, in company with an Attacker, to fly to Castel Idris airfield, Tripoli, last Tuesday, and the attempt was to be made soon as possible.

At present the unofficial record is, of course, held by Neville Duke in the red Hawker Hunter. The speed he achieved on September 7th was 727.6 m.p.h. In all fairness to the Hunter (and bearing in mind that several American speed records have been made in high temperatures and over a dry lake-bed below sea level) it must be pointed out that the speed of sound increases as air temperature goes up, at a rate of 7 m.p.h. per 10 deg F. Thus, as the Hunter's designer Sir Sydney Camm has pointed out, Duke's record of 727 might well have been 745 m.p.h. had the prevailing temperature been 105 deg F, even allowing for the loss of engine thrust due to the increase in temperature. In fact, the Hunter's speed was achieved in far from ideal conditions and with an air temperature of only 74 deg F.

It has been suggested in the daily press that the Hunter may be taken to Libya after the Swift has made its attempts in order

to see if it can better its own speed, but for various reasons this now seems improbable. There is little doubt that the top speeds of which the Hunter and Swift are capable are within two or three m.p.h. of each other. The Swift has a slightly greater angle of wing sweep; on the other hand its wing seems also to be a fraction thicker and its fuselage fatter.

The New Zealand Race

THE London-to-Christchurch (New Zealand) Air Race is now less than a fortnight distant. The contest will be started from London Airport at 4.30 p.m. on Thursday, October 8th, by H.R.H. the Duke of Gloucester.

When the entry-list was first published, seven months ago, there were 19 nominations—13 in the Speed Section and six in the Transport Handicap. Since then there have been one or two changes and—as in all events of this kind—the inevitable withdrawals. An American entry, the F-82 Twin Mustang to have been flown by Maj. H. I. Hill and Mr. J. L. Dyer, was replaced some weeks ago by a B-45 Tornado, with the same crew, and since then the Royal Aero Club—who are responsible for the organization at this end—have been notified that the B-45, in turn, has been withdrawn. Another non-starter, not altogether unexpectedly, is the channel-wing Custer Executive, which made its first flight as recently as July 13th; it was to have competed in the Transport Handicap. Other withdrawals, notified earlier, have been the Danish F-84G Thunderjet, the U.S. entry of a D.H. Hornet F.3 (to have been flown by "Slick" Goodlin), and the Spitfire 24 entered by the American Aircraft Corporation; the last-named aircraft crashed, killing P. D. Freytag, who was to have flown it in the race. There are rumours, incidentally, that the Australian Commonwealth-Mustang (F/L. Whiteman) is an unlikely starter. There now remain nine entries in the Speed Section and five in the Transport Handicap.

The R.N.Z.A.F. Hastings arrived in this country on September 11th, landing at Lyneham after an uneventful journey from New Zealand. The pilot, W/C. R. F. Watson, said that they had experienced most unusual met. conditions of a head-wind of about 35 knots all the way—"If somebody can produce the same wind-direction for the race we shall be very happy."

The Vickers-Armstrongs Valiant crew have to pack a con-

siderable training schedule into the time remaining. One of the main objects, say the makers, will be to observe fuel consumption and performance in detail; a number of full-load take-offs and landings will be made, and the results gained will be a guide to the take-off performance in the warmer, thinner air at Karachi and the Cocos Islands. During these flights, also, various "domestic" details will be examined, such as the best way to feed the crew, who will be wearing oxygen masks for much of the race-flight. The Valiant will fly in three stages, London-Karachi (4,192 miles), Karachi-Cocos (3,255) and Cocos-Christchurch (4,929)—12,376 miles in all. The R.A.F. Canberras are to make a five-stage flight.

Of the Viscount's prospects in the Transport Handicap, Vickers admit that in a world-spanning race of this kind their entry of an aircraft designed for medium-stage work cannot hope to receive the handicap allowance necessary to give it victory. Nevertheless, they expect it to give a good account of itself and to demonstrate turboprop reliability.

Full arrangements have been made for spectators; of these we shall publish particulars, including admission prices, etc., in a race-guide—giving full details of entries in next week's issue.

Promotions in Vicker's Management

SOME months ago, as we recorded at the time, Vickers-Armstrongs, Ltd., divided their business into aircraft, engineering and shipbuilding divisions. Mr. P. H. Muirhead, C.B.E., was appointed managing director of the engineering division, and Mr. G. H. Houlden, M.B.E., appointed to a similar post in the shipbuilding division. The reorganization has now been taken a stage further by the appointment of Mr. G. R. Edwards, C.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E., as managing director of the aircraft division; he was formerly chief engineer of the division which comprises the Weybridge and the Supermarine Works. It is also announced, Mr. T. Gammon, O.B.E., M.I.Mech.E., now takes over the office of general manager of that division.

Sir James Reid Young, C.A., F.C.I.S., is chairman of the company, and Major-General C. A. L. Dunphie, C.B., C.B.E., D.S.O., deputy chairman and managing director.

On December 1st two changes will be made within the engineering division. Mr. W. D. Opher, M.I.Mech.E., will become general manager of the Elswick, Scotswood, Wakefield and Chertsey Works; and Mr. J. R. Kelly will be appointed general manager of the Crayford and Dartford Works, and will be in charge of the Whitehead Torpedo Works, in place of Mr. Opher.

Fokker's Brazilian Agreement

IMPORTANT developments in the Brazilian aircraft industry are foreshadowed by an announcement from the Fokker Aircraft Company that an initial contract has been signed between the Ministerio da Aeronautica and Fokker I.A. to build under licence in Brazil 100 S-11 Instructors; 50 of the S-12 tricycle version, and 50 S-14 jet Mach-Trainers. In this connection, a new company, Fokker Industria Aeronautica S.A., was established in May this year, 50 per cent of the ownership being in the hands of the Dutch company and 50 in those of a Brazilian group.

The state-owned factory Fabrica de Galeao, near Rio de Janeiro, is being made available for a five-year period by the Brazilian Government, and the majority of the existing personnel will be merged into the new company. Technical and administrative management will be provided by the Dutch. It is also possible that an order will be placed for the F-27 Friendship, a Fokker twin-turboprop airliner designed to replace the DC-3.

Conference in Canada

IT is not generally appreciated that Avro Canada is the largest single member of the vast Hawker Siddeley Group, with over 12,000 employees on the payroll. Further, it is the only member currently mass-producing both aircraft and engines. For many months rumours have been rife concerning a project of quite revolutionary character said to be under consideration by Avro Canada at their plant at Malton, Ontario, near Toronto. Many linked this project with the term "flying saucer," and only last week the *New York Times* said that "senior U.S. Government Defence scientists" were conferring with the designers of "a disc-shaped 'plane which could reach 1,500 m.p.h. after a vertical take off." These visitors, it seems, were shown a 40ft model of an aircraft in which "the jet engine would revolve round a pilot seated in a plastic bubble."

At least it is clear that Avro Canada really are proposing something very advanced—something which warrants a conference at which these "revolutionary aeronautical projects"—as the Hawker Siddeley Group put it—will be discussed by fifteen top directors and designers of the Group, members of the Canadian Government, selected representatives of the R.C.A.F., and leaders of the Canadian aircraft industry.

The Group's senior representatives, whose names are listed below, will leave this country next month. Before reaching Canada, on the week-end of October 10th, they expect to hold discussions in New York and Washington with the U.S.A.F. and U.S.N., under the auspices of the British Joint Services Mission.

Commenting on these developments, the leader of the team, Sir Frank S. Spriggs, K.B.E., said earlier this week:

"This is the first time that our design council has met outside Great Britain and it is significant that the first meeting is being held in Canada, whose emergence as a primary air power has taken place so rapidly in the immediate post-war years. In addition, we are to have the opportunity of discussing forward planning with the U.S. Air Force and the U.S. Navy."

Further comment came from Crawford Gordon, Jr., president of Avro Canada. In Toronto he said: "We look upon this visit to Canada as a clear sign of Canada's coming-of-age as a designer and manufacturer of aircraft. Such a visit could not have been considered a few years ago. We have projects under way that are as advanced, perhaps more advanced, than anything we know of in the Western World."

The following will take part in these discussions:

Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S., managing director, Hawker Siddeley Group, Ltd., chairman of design council. **Sir Roy Dobson,** C.B.E., J.P., F.R.Ae.S., managing director, A. V. Roe and Co., Ltd., director, Hawker Siddeley Group, Ltd. **Sir Sydney Camm,** C.B.E., F.R.Ae.S., director and chief designer, Hawker Aircraft Company. **Mr. Wilfred G. Carter,** C.B.E., A.F.R.Ae.S., technical director, Gloster Aircraft Company, Ltd. **Mr. Stuart Davies,** B.Sc. (Eng.), F.R.Ae.S., chief designer, A. V. Roe and Co., Ltd. **Mr. John Lloyd,** F.R.Ae.S., technical director, Sir W. G. Armstrong Whitworth Aircraft, Ltd. **Mr. William H. Lindsey,** M.A., F.R.Ae.S., director and chief engineer, Armstrong Siddeley Motors, Ltd. **Dr. L. W. J. Newman,** B.Sc., A.R.C.S., D.I.C., Ph.D., A.F.R.Ae.S., chief engineer, armaments division, Sir W. G. Armstrong Whitworth Aircraft, Ltd. **Sir William Scott Farren,** C.B., M.B.E., M.A., F.R.S., M.I.Mech.E., F.R.Ae.S., technical director, A. V. Roe and Co., Ltd. **Mr. W. P. Saxton,** M.B.E., director and general manager, Armstrong Siddeley Motors, Ltd. **Mr. Henry R. Watson,** B.Sc.(Eng.), A.F.R.Ae.S., chief designer (aircraft), Sir W. G. Armstrong Whitworth Aircraft Ltd. **Mr. Reginald Jones,** M.Sc., chief metallurgist, High Duty Alloys, Ltd. **Mr. Richard W. Walker,** F.R.Ae.Ss, chief designer, Gloster Aircraft Co., Ltd. **Mr. Crawford Gordon, Jr.,** O.B.E., president and general manager, A. V. Roe, Canada, Ltd. **Mr. James C. Floyd,** A.F.R.Ae.S., M.I.A.S., chief design engineer (transports), A. V. Roe, Canada, Ltd.

Australia and Guided-Weapon Costs

THE Ministry of Supply recently announced arrangements by which the cost of guided-missile development in Australia—a subject that has lately been arousing some concern in the Commonwealth—will be more equitably shared by the two Governments. Following are extracts from the text of the announcement, which was issued as a result of meetings between Mr. Menzies, Mr. Duncan Sandys, and other officials:—

"Up to the present the Australian Government have borne the cost of all industrial work carried out by private firms in Australia in connection with the testing of guided weapons on the Woomera range. The United Kingdom Government has agreed that in future it will bear the cost of any such work which may be done to its order. The Australian Government, on the other hand, have agreed to take over a greater financial responsibility for certain equipment ordered by them for the Woomera range.

"The effect of these changes on the respective financial liabilities of the two Governments will depend on the amount and nature of the work being done and will therefore tend to vary from year to year.

"Finally, the Ministers agreed that this vital defence project should, as hitherto, be pursued in a spirit of partnership, and that it should continue to be accorded high priority by both Governments."

From October 1st, about 80,000 square miles of South Australia will be sealed off—as far as is practicable—in preparation for the forthcoming series of atomic and other tests.

In recent months there has been much ill-feeling in Australia engendered by the heavy burden in taxation imposed by the range and by the manner in which Australians have—it was felt—been shouldered aside so that the range area could be kept exclusively British. Such impressions are, of course, wholly false. Such an undertaking can only be a joint effort, and it is to be noted that, for the first time, many missiles wholly, or mostly, made in Australia will soon be fired at Woomera. Faireys are the company concerned, and they have turned out many supersonic test vehicles with the aid of their sub-contractors at Salisbury.

Another fact likely to please the Australian public is the inclusion of members of their civil defence organizations as observers, or even participants, in the tests. According to the *Melbourne Herald*, extensive experiments would be undertaken to determine the strength of radio-activity remaining in wrecked buildings, vehicles, and other structures.

Another series of tests will, in the opinion of the *Sydney Sunday Herald*, be directed towards a study of the effect of heat, blast and atomic radiation on a number of new metal alloys and plastics. The report, quoting "reliable London sources" said that, if the tests were successful, the materials might be used in the construction of British bombers to combat atomic blast.

BATTLE of BRITAIN COMMEMORATION

First all-jet Fly-past: Reports from Stations Open to the Public

IN autumn haze, reminiscent of conditions during the actual battle thirteen years ago, 252 jet aircraft—led by a Hurricane and a Spitfire—flew over London at 12.30 p.m. on Tuesday, September 15th. On Saturday last 70 R.A.F. Stations were "At Home" to the public.

From the roof of *Flight's* office, over which the Battle of Britain formation passed, the directing marker flares could be seen glowing on the roof of the London County Hall. The two veteran fighters flew in line abreast as co-heroes of the battle and were followed by the jets in 11 formations. As would be expected the main body of the fly-past was made up of Meteors—120 of them—followed by Sea Hawks, Sabres (from both the R.C.A.F. and U.S.A.F.) and two formations of Canberras. The standard of formation keeping was very high. A formation of 24 Canberras also flew over Leicester and other Midland cities.

It will be remembered that Sir Winston Churchill was awarded his honorary "Wings" for the manner in which he inspired the nation during the Battle of Britain. It was, therefore, singularly appropriate that after the fly-past the following message should have been sent to him by Fighter Command as he was flying in a Viking of the Queen's Flight from Dyce to London: "On this the thirteenth anniversary of the Battle of Britain, the remainder of 'The Few' salute and send greetings to the Prime Minister, their war-time colleague in arms, as he flies today through the free skies of Britain."

The 70 R.A.F. Stations "At Home" last Saturday were spread over the whole of Britain and N. Ireland. For all there were static displays of aircraft and equipment, at which the mechanical minded—both young and old—could turn handles and press buttons to their hearts' content.

Flying programmes also showed a variety of attractions. Dishforth (Yorkshire) had a handicap race in which, among others, a Tiger Moth and a Hastings took part. Manby (Lincolnshire) also held an air race. At St. Mawgan (Cornwall) a Shackleton and a helicopter combined to demonstrate an air/sea rescue, and at Newton (Nottinghamshire) R.N.V.R. Sea Furies showed deck-landing and take-off techniques.

Oakington (Cambridgeshire) was able to demonstrate a Bristol Fighter of 1917 vintage and at the R.A.F. Regiment depot at Catterick (Yorkshire) a set piece depicted an attack by Aden Protectorate Levies on an enemy stronghold.

Feltwell (Norfolk) provided a fly-past of 88 aircraft of the R.A.F., R.N., R.C.A.F. and U.S.A.F., and visitors to Ouston (Northumberland) were given the privilege of buying products of the station farm. The Handley Page Victor visited Hendon (Middlesex), Biggin Hill (Kent), Hornchurch (Essex), Duxford (Cambridgeshire) and Wyton (Huntingdon).

Below are short reports from a few of the stations.

Thorney Island

OVER 7,400 visitors went to Thorney Island and were rewarded with five hours of excellent entertainment. Particularly rich in interest was the aircraft park, which even included the orange Avro 707 delta—it may be that the station commander of Farnborough, being a member of the Thorney Island sailing club, had something to do with this.

The show opened with a graduation parade of No. 20 Navigation Course, at which Air Marshal L. F. Pendred, A.O.C.-in-C. Flying Training Command, took the salute and presented wings.

After the school Ansons and Varsities had taken off for formation flying, a Chipmunk from Hamble gave a very good, if distant, display of aerobatics. This was followed by a balloon-bursting demonstration, reminiscent of a week-end flying meeting a quarter of a century ago.

Lt.-Cdr. Spedding, R.N., brought a Bell helicopter over from Gosport to give a very spirited display.

The Meteor display which followed was hampered somewhat by low cloud, but it was given with a good sense of showmanship, the aerobatics being well within the public view all the time. Then came demonstrations by aircraft from the static park, aided by a Coastal Command Sunderland which flew at nought feet with both port airscrews feathered. The Avro 707, with wheels down, showed its slow-flying capabilities and then, with everything tucked up, went by at speed to finish with a hesitation roll. It was flown by S/L W. J. Potocki, D.F.C., a Farnborough pilot. In the circuit at the same time were a Canadian Sabre, in the hands of F/O Potter, R.C.A.F., and a Canberra from Hemswell flown by F/L Robertson.

In sudden contrast to speed and noise came the next item—a race round the sticks by three Tiger Moths. The course was laid inside the airfield and any old hand watching it was perforce reminded of the pre-1914 race days at Hendon. The remainder of the programme was unashamedly devoted to public taste. Varsities, Meteors and Shackletons all attacked, intercepted and bombed. A set piece was destroyed—presumably by a delayed-action bomb!—and the flashes, bangs and other "noises off" had a Brock's benefit air about them.

J. Y.

Valley

SIXTEEN different types were listed on the visiting aircraft board in Valley control tower on the morning of "At Home" day. Between a Sea Hawk and a Meteor 8 was scribed an incongruous Gemini, call-sign FLT, for *Flight's* Gemini was making a visit to North Wales.

Most of the planned items on the afternoon's flying display did in fact take place, in spite of a low, ragged cloudbase which varied between 400 and 1,000ft. The three touring Lincolns were behind schedule, but individual aerobatics (Vampire 5) and formation drills (Vampire T.11s) by the home station, and a fly-past by the Pembroke Dock Sunderland, continued as arranged.

A Beaufighter flown by Short's pilot, Mr. Kay, then gave a demonstration of its normal work, towing a target drogue to be shot at by a Bofors crew. The Navy's Attacker was to have demonstrated dummy deck landing, but weather limited it to low runs past the crowd (which numbered some 3,500). Aerobatics by four Vampire 5s from Valley and a Balliol from Cottesmore preceded the fly-past prior to their departure of aircraft which had been in the static park. This selection ranged from one of Marham's B-29 Washingtons to a Hooton Park Auster.

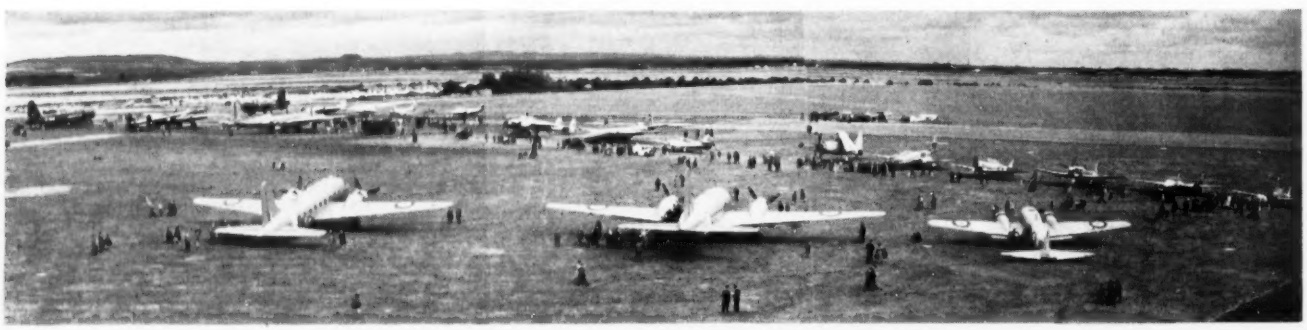
K. T. O.

Hawarden

BISYLLABICALLY pronounced "Harden," this was the second station to be visited by *Flight's* Gemini last Saturday. Taxying in past an impressive line of static-show machines, we parked behind five aircraft later to race each other over two laps of a triangular course; these racing machines, whose variety was matched only by their competitive improbability, consisted of a Tiger Moth, Lincoln, Proctor, Mosquito, Anson and Venom.

Great ingenuity had been shown by the organizers who, obviously determined to divert the urge of the small boy to damage aircraft into a more acceptable yet compatible channel, had provided for their especial use an unwanted but intact Horsa fuselage. This the younger generation was allowed feverishly to attack, stripping away torn souvenirs and, termite-like, effecting rapid and complete destruction. Other distractions provided for the public—over 10,000 of whom were present—included an excellent static display.

Typical of the 70 R.A.F. stations "At Home" last Saturday. Visitors in the aircraft park at Thorney Island. This photograph was taken from the roof of a hangar "blitzed" in 1940.



Flying was started with individual aerobatics by a Vampire 9 and a formation fly-past by eight Meteor 8s from the Hooton Park auxiliary squadrons. A Chipmunk, an Auster, four Vampire 5s and a Shackleton showed their respective paces, and were followed by S/L Storrer in a series of well-judged aerobatics and high-speed low runs in a Meteor 8. The Vulcan was unable to appear, but two other unfamiliar shapes were a restrained Neptune from Topcliffe, and the stately touring Sunderland.

Immaculate formation drill by 12 Harvards preceded a sprightly Provost demonstration by F/L Manson, of 173 squadron, and a brisk, noisy show by F/O Kelly, of 613 (City of Manchester) Auxiliary squadron, in a Vampire 5. Sailplane aerobatics and a three-Lincoln fly-past preceded the afternoon's most intriguing time—the handicap race (staged by 173 squadron) between the five machines mentioned above. This was won by the Tiger Moth, with the Lincoln second and Proctor third, and the unfortunate Venom (carrying a brutal handicap) last.

The flying display was concluded with demonstrations by a Canberra from Scampton, and a Spitfire 16 (normally used for anti-aircraft co-operation work) flown by F/L. Crummit.

K.T.O.

Little Rissington

THE Central Flying School at Little Rissington entertained some 8,000 visitors to a most interesting display of great variety, which included some 27 different types of aircraft, ranging from a B-47 (from Brize Norton) to a Provost (from South Cerney).

The Mayor and Mayoress of Cheltenham, the guests of honour, arrived just before F/Lt. J. C. Steele (C.F.S. Examining Wing) flew past very low in a Sabre at an I.A.S. of 570kt and from then on there was never a dull moment. F/Lt. W. C. Kendall gave a superbly polished performance in a Vampire and was always back on the spot in a far shorter time than is usual in a jet aircraft; his full bunt and inverted turns were particularly neat. F/Lt. R. G. Price in a Meteor T.7 also gave a fascinating show.

In contrast to noise and speed, Mr. G. S. Neumann, from Cambridge, gave a delightful aerobatic show in his Olympia, and found well-deserved applause when he landed in front of the V.I.P. enclosure. The Dragonfly, flown by Lt. Turpin from Gosport, demonstrated how to rescue bathers with cramp. The C.F.S. aerobatic team were hampered by the cloud, but the take-off was impressive, with No. 4 only three lengths behind the leader in the "box." Their final fly-past was unusual, in that the leader was inverted (true C.F.S. style). The Canberra from Manby, flown by F/Lt. Adcock, was limited by tip tanks, but, after an Auster-like take-off, did a very slow run downwind and high-speed run into wind—just to be different! The Royal Cypher "E.R." was beautifully shown by the 21 Harvards which had simultaneously started up to an R/T signal, and who later helped to demolish a fort by a gloriously noisy dive-bombing attack.

The crowd were delighted to see the lone Hurricane fly low in front of the enclosure, and the arrival of Bill Waterton in the Gladiator. The Sabre team from North Luffenham flew some superb rolls in very poor conditions.

J. S.

Biggin Hill

THE visitors to this famous Battle of Britain station, who numbered more than 150,000, were treated to a display of flying such as is rarely staged at a Service airfield. For four hours, a continuous succession of flying events of all types was presented, including fly-pasts of such aircraft as the Victor, the Avro 707A, Shackletons, Varsities and Ansons. A mock cruiser, defended by the guns of 2600 Sqn, R. Aux.A.F., was strafed by Meteors and convincingly pulverized by Thunderjets. Among a series of formation aerobatic teams were those of the re-formed Skyblazers, giving their usually polished display in F-84s, and Biggin Hill's own teams from Nos. 600 and 615 Sqns, R.Aux.A.F.

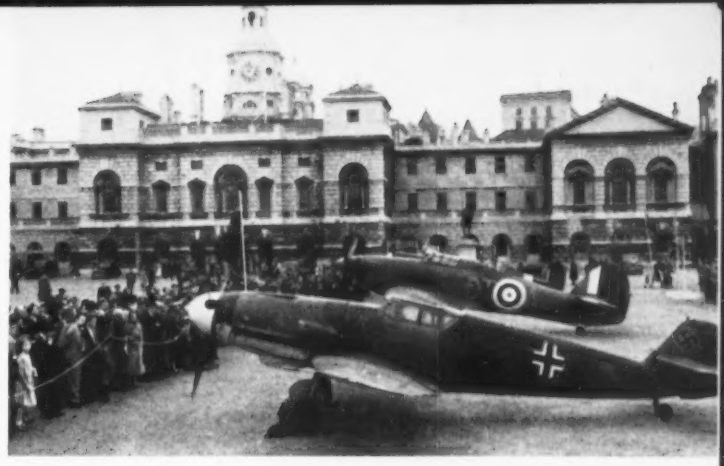
The Special Air Service gave a display of parachute-jumping from a balloon, and, despite high wind, one paratrooper descended actually pedalling his airborne bicycle. Among the old-timers put through their paces were the Tiger Moth, the Hurricane and Spitfire. On the ground, an extensive display of Service exhibits.

M. C. L.

Hendon

IT was a happy thought to open the flying programme at Hendon with a flypast by a Spitfire 16. The characteristic crackle of its Merlin must have evoked a host of memories from the crowds, many of whom were familiar with the history of this famous airfield—rich in its associations with flying since the earliest days in 1910, and the scene of the original R.A.F. displays. Item No. 2 was a flypast by four tip-tanked Canberras from Hemswell, soon followed by the Victor—as impressive as it was unexpected. Another unscheduled item was some spirited low-level duties by three A.O.P. Austers. The whine from an ungeared airscrew heralded some pretty aerobatics from a Harvard.

At this time scattered cloud at 2,500 ft was lifting, to reveal a watery sun trying to break through a thin overcast at 16,000 ft. A disappointment for the public was the cancellation of a flypast by an Avro Vulcan owing to bad weather in the Woodford area. F/L. R. Edwards brought over an Anson, that venerable old lady of the Service, for the height-judging competition. Equally lively performances came from a Chipmunk (F/O Martin) and a Sycamore from Middle Wallop, in the now rather unfamiliar "sand and spinach" camouflage, and deftly flown by Capt. J. B. Spittal. Ansons and Chipmunks, drawn from the Metropolitan Communications Squadron (No. 31) carried out some neat formation work followed by individual aerobatics and a low-level beat up by a Meteor from Biggin Hill. About this time a V.I.P. Devon landed with the Under-Secretary of State for Air on board.



Old enemies. An ME 109 and a Hurricane on view at the Horse Guards Parade. The tail of a Spitfire appears just beyond the Hurricane.

The take-off of an A.O.P. Auster, and the appearance of a convoy of army lorries in the middle of the airfield just to the west of the runway in use, was the signal for the time-honoured "set piece", an attack by a Meteor 7 from Benson on an army column.

Pleasure flights were provided throughout the afternoon by a Dakota and Rapides of Hunting Air Transport. In addition to the two Canberras and Victor, the crowd saw Varsities, Meteors, Ansons, Mosquitoes, Lincolns, and 16 Meteors from Biggin Hill.

Aston Down

AN air of gloom pervades at met. briefing on the morning of any flying display, and last Saturday, at R.A.F. Aston Down, was no exception, when the weather man pinned his chart on the wall of 187 Squadron's Ops. Room, to reveal the customary series of blue and red lines approaching rapidly from the west. But the programme opened on time, with a visiting Vampire from Filton. This being over, there was an opening speech by the local Member of Parliament, followed immediately by three Meteors performing various formations at the request of the spectators; two of these machines, F.R.9s, then landed whilst the third, an N.F.11, was joined by an Anson for the inevitable height-judging contests.

A little feeling of nostalgia crept into the next item, when three Mosquitoes of the writer's old P.R. squadron (No. 58) flew past, led by one of the only four existing P.R.35s.

The attention of the crowd was next claimed by a Harvard from South Cerney, which executed some extremely neat manœuvres, and by a Meteor F.R.9 flown by F/L. Kudrewicz, 187 Sqn. flight commander. In turn there followed displays by a Dragonfly, three Shackletons, a mixed flight of Sea Hawk, Attacker and Wyvern (the last-named trio made an unexpectedly high-speed fly-past), by a Canberra and a dilapidated Tempest 6.

By this time the crowd had been worked into a state of enthusiasm over the promised arrival of what was definitely the very last Wellington. Eventually a T.10, MF 628, appeared and flew past once at little under a thousand feet, hardly a befitting end to the career of such a famous type.

Following a run by a squadron of Meteor F.8s, the only true vintage representative of the day made a brief appearance in the ex-Bellamy Gladiator G-AMRK.

A two-lap handicap race between seven assorted machines was the next item, and this was won by P/O Wells in a Chipmunk with F/Sgt. Gill in a Meteor 9 second, and Varsity, Canberra, Spitfire, Provost and Anson following them up.

A sonic boom by a Sabre from a "rival" M.U. at Kemble failed to materialize—but the aircraft did, and completed two impressively speedy runs before departing homewards.

The next event was refreshingly lively. Defying the size and weight of his mount, F/Lt. Trimble from the Ferry Training Unit at Benson demonstrated his Lincoln with enthusiastic abandon on four, three, two and finally one "fan."

By this time the programme was tailing-off in intensity and after a considerable gap eight Vampires appeared and disappeared equally quickly.

As a fitting finale some spirit was pumped back into the proceedings when F/Sgt. Marshall, a test pilot on 20 M.U. at Aston Down, performed some very smooth aerobatics in a Spitfire 16.

D. F. O.

HERE AND THERE

"Flight" photograph

TEMPORARY TERMINAL: Pending completion of the ultra-modern terminal illustrated on pages 432-3 of this issue, London Airport's administrative, passenger-handling and control services will remain in the area immediately south of the Bath Road. This view of the buildings and marshalling apron was secured recently from a Bristol 171 helicopter.

Royal F.R.Ae.S.

THE DUKE OF EDINBURGH has accepted an invitation to become an Honorary Fellow of the Royal Aeronautical Society. The announcement was made by Sir William Farren, R.Ae.S. president, at the Anglo-U.S. Conference dinner on September 17th.

Expensive Beat-up

A U.S.A.F. B-47 pilot who caused considerable public alarm last June by circling Cardiff several times at low altitude has been punished by being permanently grounded, reprimanded, and deprived of £70 pay.

For Indian Defence

ACCORDING to a report from India, attributed to Mr. Mahavir Tyagi, Minister for Defence, his Government intends to set up a factory to produce aero engines. In addition it is probable that an order will be placed for Fireflies for the Indian Navy.

Polar Piasecki Flight Cancelled

IT was reported in Washington on September 17th that two U.S.A.F. twin-rotor Piasecki helicopters were at Thule Air Base, about 900 miles from the North Pole, awaiting weather suitable for a flight to the Pole and back. Four days later the flight was abandoned as "not worth while."

The Sun Rises Further

SLOWLY, but very surely, Japanese aviation is rising from the dead. Last Sunday, September 20th, a national aviation day was celebrated, and all the dozens of simple, conventional, back-yard prototypes built in Japan during the past year took part in an air festival, together with the airliners operated by Japan Air Lines on domestic routes and, in the near future, international services also. Newspapers, radio and television companies and other sponsors put on a meeting of pilots—of whom 200 hold current licences—and aircraft manufacturers. The order of 1945 forbidding the Japanese to fly powered aircraft was, of course, rescinded last year. Several colleges and universities are expected shortly to offer glider training in their sports curricula.

Turkish Airfield Programme

APART from military air bases now under construction, Turkey is going ahead with the construction of a number of civil airfields. Contracts are reported to have been signed with an American firm for the preparation of sites at Diarbakir, Kenya ad Eskisehir, at a cost of £T32,000,000.

Pilotless Prang

A ROBOT target aircraft, of unspecified type, crashed into a house at Stiffkey, Norfolk, last Sunday, without causing serious damage or casualties. As the local inhabitants know well enough, there is a ground-to-air firing range in the area, and both British and American army units have been operating pilotless target aircraft there since 1951. A U.S. Air Force spokesman said that, last Sunday, the target in question did not "pop its chute" and, proper radio control having been lost, it went into a steep dive at 400ft over the sea, finally passing over the U.S. Army camp and into Stiffkey village.

TO BOOM DOWN-UNDER: This first air-to-air view of the prototype Commonwealth Sabre shows the increased fuselage depth, bigger intake to feed the Rolls-Royce Avon, and the blast tube for the starboard 30mm gun. Like the F-86F and H, this Sabre can carry an underwing offensive load. In the hands of F/Lt. Bill Scott this fine aircraft has exceeded Mach one many times.

Austers for Antarctica

TWO Austers fitted with floats are to be attached to this year's Australian Antarctic Expedition. They will be used to guide the Expedition ship through ice packs and for reconnaissance of the Antarctic mainland. F/L. D. Leckie, who was with 77 Squadron in Korea, will be in charge; the second pilot will be Sgt. R. S. Seaver, and Sgt. K. W. Duffel will look after maintenance.

An R.C.A.F. Loss

ONE of the best-known demonstration pilots of the R.C.A.F., S/L. Ray Greene, was killed on the Canadian National Air Day last Saturday, September 19th. He had been giving a Sabre exhibition before a crowd of 60,000 at Toronto; after looping, the Sabre dived towards Lake Ontario apparently out of control and, after skipping along the water for some hundreds of feet, blew up.

More Molybdenum

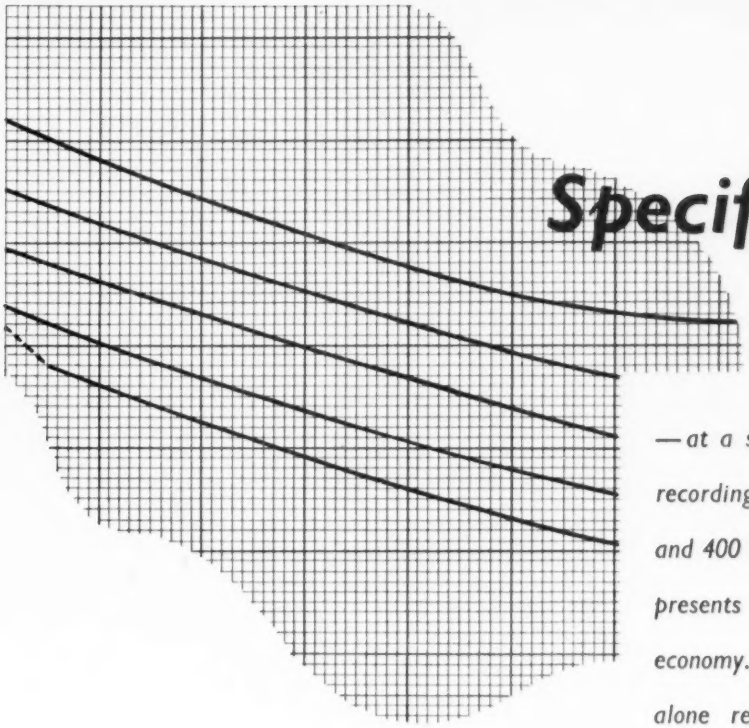
ON Monday last, September 21st, restrictions on the use of molybdenum in certain forms of alloy steel, imposed by the Ministry of Supply in June 1952, were removed. Restrictions on the use of nickel continue.

The Advance of Titanium

FOR use in a "special research project for the U.S.A.F.," an 8ft 4in airscrew blade—designed by Hamilton Standard Division of United Aircraft—has been forged in titanium 140-A high-strength alloy. The forging was made by the Ladish Co., of Cudahy, Wisconsin, in what is claimed to be the largest closed-die hammer in the world.

W-S 51 in Wales

NEWPORT, Monmouthshire, had its first experience of the helicopter when, on September 18th, the Mayor and members of the Council made flights in a Westland-Sikorsky 51 with Mr. John Fay, the makers' instructional pilot, at the controls. The progressive Town Council has already selected a site at Shaftesbury Park for use as a helicopter station some time in the future. Witnesses at the demonstration were Mr. Mostyn Davies, a B.E.A. representative (he had no direct interest), and W/C. R. A. C. Brie, in charge of B.E.A.'s Helicopter Experimental Unit.



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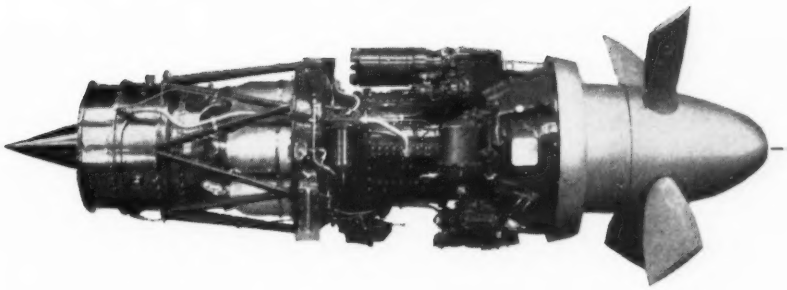
—at a specific weight of 0·52 lb./e.h.p. and recording a specific consumption at 30,000 ft. and 400 m.p.h. of 0·48 lb./e.h.p./hr. the Eland presents a prospect of marked operating economy. The reduction of installed weight alone represents a substantial increase in revenue potential of particular value in medium-range inter-city operation.

ELAND



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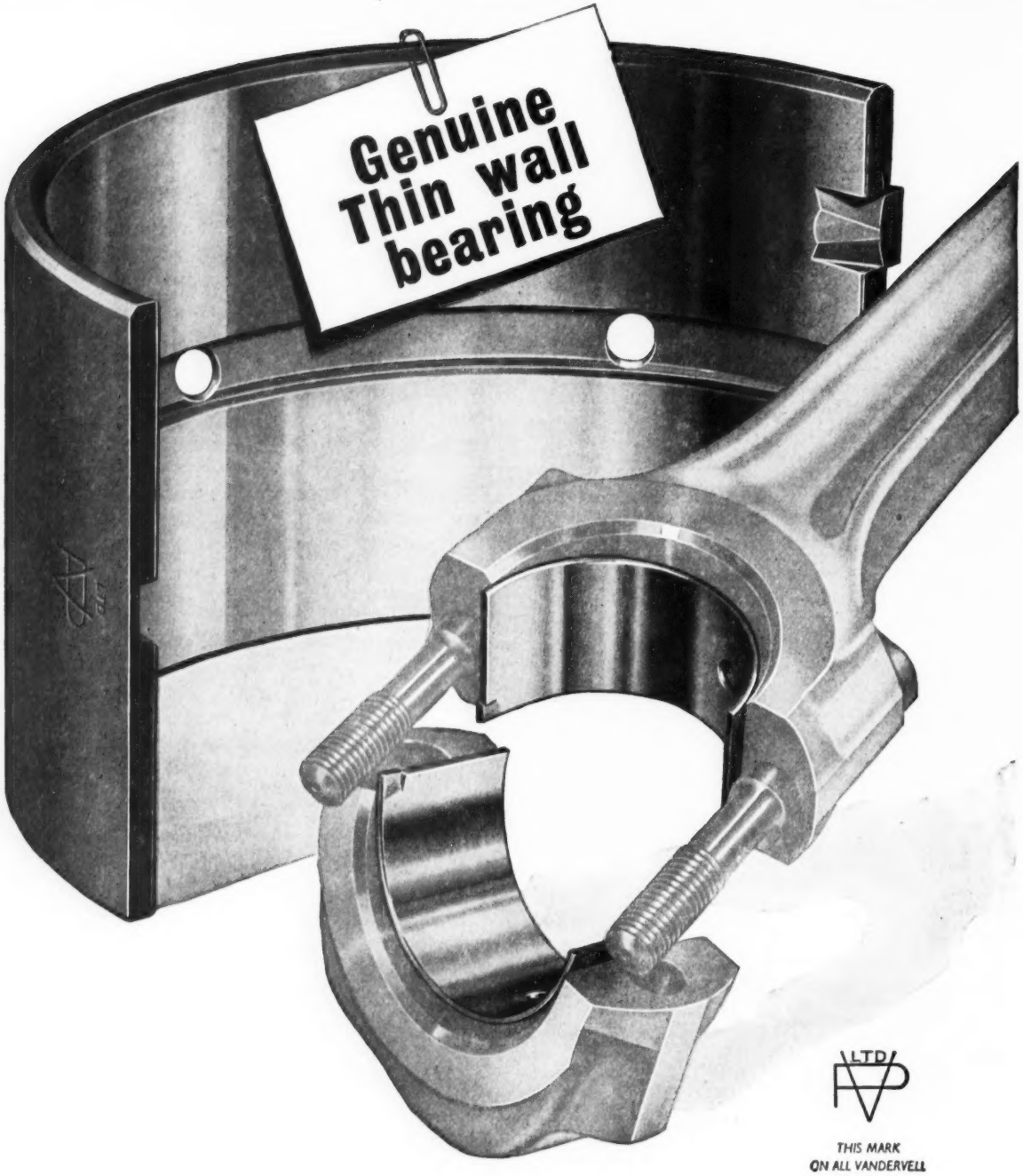

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THE WILBUR WRIGHT LECTURE

A Digest of Professor Hoff's Paper on Buckling: R.Ae.S. Awards Presented

THE steep-tiered lecture room of the Royal Institution was crowded on September 14th, as members of the Royal Aeronautical Society and the Institute of the Aeronautical Sciences met together to hear the 1953 Wilbur Wright Memorial Lecture and to see the presentation of the Society's foremost awards. The lecture, given annually and alternately by American and British speakers, was on this occasion entitled *Buckling and Stability*, and was presented by Professor N. J. Hoff, who is head of the Department of Aeronautical Engineering and Applied Mechanics at the Polytechnic Institute of Brooklyn, New York.

Before the lecture, as we briefly recorded last week, the awards were presented by the President, Sir William Farren. Honorary Fellowships were awarded to Sir Geoffrey de Havilland and Sir Arthur Gouge, and mention was made of the same honour—to be conferred at a later date—to Lord Hives. Sir William then paid a tribute to the late Professor L. Prandtl, one of the few men to have the triple honour of being a Gold Medallist of the Society, an Honorary Fellow and a Wilbur Wright lecturer.

The Society's Gold Medal, the highest honour it can confer (awarded first in 1909 to the Wright brothers), was next presented to Mr. E. F. Relf, C.B.E., F.R.S., F.R.Ae.S., Principal of the College of Aeronautics from 1946 to 1951, for his outstanding contribution to aeronautical science over a period of many years. Mr. H. Grinsted, C.B.E., B.Sc., F.R.Ae.S., received the Society's Silver Medal for his outstanding work in aeronautical engineering; and the Society's Bronze Medal was awarded, for his work on the development of Naval aircraft, to Mr. L. Boddington, Director of Military Aircraft Research and Development, Royal Navy.

The British Gold Medal for Aeronautics went to Mr. R. E. Bishop, C.B.E., F.R.Ae.S. (de Havilland Aircraft), for his outstanding contribution to aircraft design, and Mr. J. E. Gordon, B.Sc. (R.A.E., Farnborough), received the British Silver Medal "for his excellent work in the sphere of aircraft structural plastics." For his paper, *The Fatigue of Aircraft Materials with Special Reference to Micro-Structures*, Major P. L. Teed, F.R.Ae.S., received the Simms Gold Medal of the Institution of Aeronautical Engineers, whose Wakefield Gold Medal was presented to Mr. F. W. Meredith, B.A., F.R.Ae.S., for his work in the design of automatic pilots and aircraft instruments. G/C. E. A. Whiteley, D.F.C., B.A., A.F.R.Ae.S., who qualified for the award of the George Taylor Gold Medal for his paper *The Spacing of Aircraft under High-Density Conditions*, was unable to receive his award that evening, for his work lies overseas; he is Director of Plans, Far East Air Force.

Column-theory Developments

The Wilbur Wright Lecture was then given by Professor Hoff. He began by tracing the historical development of the theory of columns, stating that, although columns built almost 5,000 years ago still stood in Egypt, the first theoretical calculation of the load-carrying capacity of columns was published by Euler only 209 years ago. This classical theory, applying to perfectly elastic long columns, he continued, was widely known at the time when Wilbur and Orville Wright designed and constructed their first gliders and powered aircraft; and, although such a rational theory of the inelastic buckling of short columns was not generally available, practical engineers had enough empirical information to permit them to design safe columns without undue weight. An interesting extract from Orville Wright's diary referring to strength tests made on the completed powered aircraft before its first flight was quoted by the lecturer.

The establishment of a rational theory of short columns was first made possible by the results of investigations by von Karman published in 1910, Professor Hoff continued. On the assumption of small deformations, von Karman derived a simple formula for the buckling load of a short column, and was the first to give simple closed-form expressions for the reduced modulus of the solid rectangular and the idealized I-sections. The major features of the experimental work performed to verify the theory were the careful determination of the compressive stress-strain diagram of the metal of the column, and the accurate centering of the specimens under load by means of adjustable knife-edge end-fittings. Von Karman also made rational corrections in the evaluation of the test results to allow for the increased rigidity of the column in the region of the end-fittings.

A new approach differing considerably from the classical analysis was put forward by Shanley in 1946. While the results of ordinary tests on slender columns gave good agreement with the classical theory, the performance of short columns, thin-walled cylindrical shells and flat plates provided large discrepancies, the buckling load in general proving considerably smaller than that predicted by the Eulerian theory.

Shanley's thesis was that the tangent-modulus load, suggested earlier by Professor Engesser, should be accepted as the correct buckling load. Assumptions on the two theories were different (according to the earlier theory, the column end-points were subjected to a fixed axial compressive load, while on the Shanley system the end-load changed continuously during the buckling process), but the acceptance of the newer concept did imply the rejection of the classical view of stability.

The lecturer went on to give an analysis of the dynamics of the motion of a column during the buckling process in a normal column-test, beginning with the equations of motion of a perfectly elastic column. From these, he went on to deal in turn with the elastic buckling process and a consideration of the static solution with vibrations superimposed. His description of the experimental test apparatus and results was followed by the development in detail of a dynamic theory for short columns. Phase plane diagrams were then shown by Professor Hoff, who went on to describe the continued experiments performed in order to check the theoretical conclusions.

Static and Dynamic Criteria

The penultimate section of the paper was concerned with the determination of the buckling load in the cases of slender columns, short columns, flat plates and thin cylindrical shells respectively. An account of the Duberg-Wilder definition of critical load, and the Pearson-Prager criterion of buckling was followed by a consideration of experimental proof of the correctness of the tangent-modulus load, and of the relation between the static and dynamic criteria of stability.

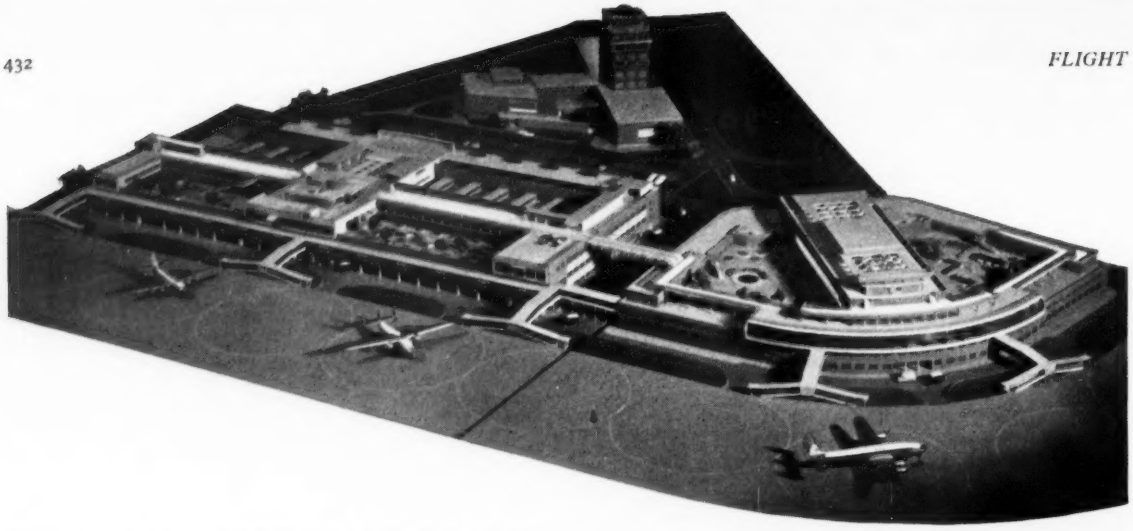
Summarized conclusions were then expressed by the lecturer. A short column compressed in the testing machine with the distance between its two ends fixed could be stable when the disturbance was small, and unstable when the disturbance was large; consequently it might buckle before its stability limit was reached in the sense of the classical small-deflection theory. A column whose material was subject to creep was unstable under a compressive load of any magnitude, but it might not buckle during the lifetime of the structure of which it was a part. Buckling under a static load following a disturbance had many aspects differing significantly from buckling during a loading process, particularly when the latter was rapid, and there were material differences between the various kinds of loading processes.

For these reasons it was desirable to distinguish between the stability of a fixed system in the classical sense and the stability of a loading process. There was no reason to believe that an arbitrarily chosen loading test would furnish values that could prove or disprove the classical theory of static stability. There was even a great deal of an arbitrary nature connected with the definition of the buckling load in a loading process.

It seemed advisable to reserve the terms "critical load" and "characteristic value of the load" for the designation of theoretical loads at which the state of equilibrium was of a special character. Thus the load at which the limit of stability was reached in accordance with the classical small deflection theory, or even according to a large deflection theory, was properly called a critical load. Common sense required that the load at which a column or a thin-walled cylinder buckled suddenly in a loading process should be designated as the buckling load.

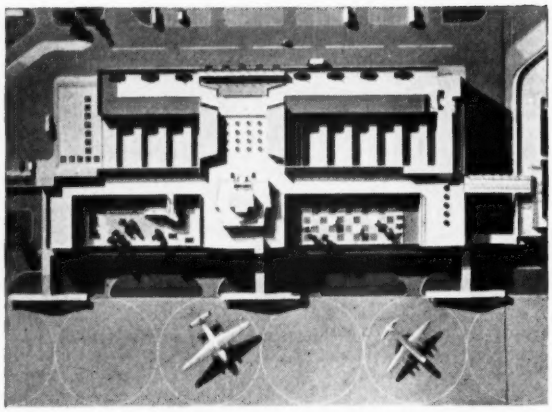
The audience's thanks to the lecturer were voiced in a forthright and amusing manner by Mr. George Edwards, chief engineer of Vickers-Armstrongs aircraft division and a vice-president of the Society, who pointed out first that "this business of struts and things has been plaguing people in the structures game for many years." After commenting that the assumptions of some present-day engineers made the prognostications of the Greeks (the proportions of whose columns were based on those of the human body) seem most scientific by comparison—yet another reason for "the creeps"—Mr. Edwards referred to "putting a bit extra on everything" after theoretical calculation: this, of course, was what every stressman did.

In serious vein, Mr. Edwards congratulated Professor Hoff on the unparalleled presentation of the lecture—a highly specialized one, in contrast to the reviews of wide fields covered by his predecessors—and welcomed him and his fellow delegates to the joint aeronautical conference.



L.A.P. ADVANCES

New Buildings for Britain's Premier Airport



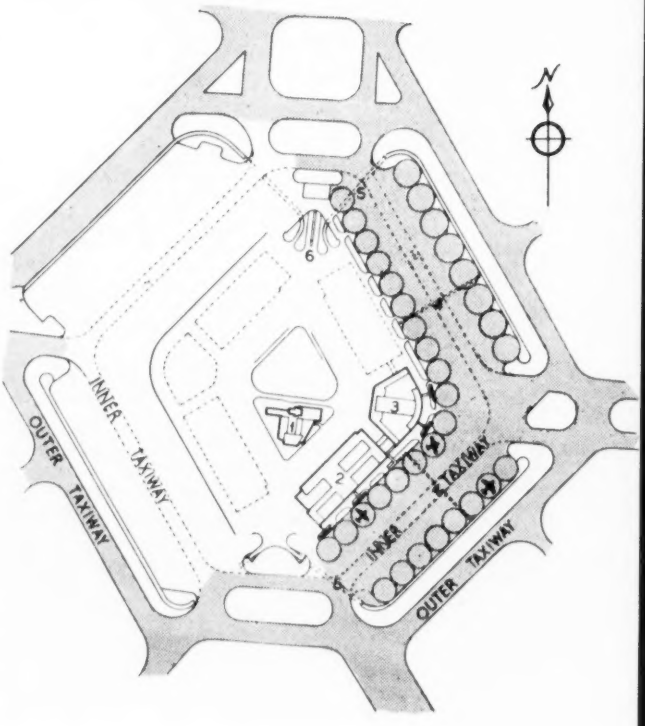
LONDON Airport, with its six great concrete runways, has in seven and a half years of operation proved equal to practically all the heavy demands placed upon it by the rapid growth of international air traffic. An airport can only be as good as its runway system and its radio and radar facilities; and in the initial post-war development phase, the Ministry of Civil Aviation wisely concentrated on making London Airport a model of technical efficiency. Passengers and airline offices were at first accommodated in canvas tents and later in "an agglomeration of army hutments"; the construction of freight buildings and control tower was also on a provisional basis. Thanks to the commandant, Sir John d'Albiac, and an efficient staff, the present collection of terminal buildings south of the Bath Road has so far proved adequate under most conditions.

Well before the Government's recent announcement of its plan to reduce the number of civil airports serving the London area from seven to three, it had become evident the construction of permanent terminal buildings at L.A.P. could not be long delayed. The most important factor is the impending return of Northolt to the R.A.F., which will greatly swell the already considerable growth in the number of passengers using London Airport. Last year these two airports handled 90 per cent of London's air traffic —some 1,605,000 passengers, of whom 767,000 used Northolt.

It had been intended from the outset that L.A.P.'s permanent terminal building should be erected in the centre of the hexagonal pattern formed by the intersection of the six runways. The preliminary steps towards making use of this vast area (158 acres) have in fact already been taken. Construction was recently completed of a tunnel, 2,000ft long and 86ft wide, providing access to and from the Bath Road. Last January work began on the superstructure of the new centrally placed control tower, and it was announced at the time that this was the first of a group of traffic-handling buildings designed by Mr. Frederick Gibberd, F.R.I.B.A., M.T.P.A., on behalf of the M.C.A.

Details of these buildings were revealed for the first time on September 16th by the Minister of Civil Aviation, Mr. Alan Lennox-Boyd, who expressed a belief that they would make L.A.P. an airport worthy of British aviation—"the finest in the world." There was no controversy, he said, about the need for these permanent buildings; much of the early work had in fact been done by the Labour Government. Mr. Gibberd, said the Minister, had done a fine job. Design of all three buildings, he added, had been approved by the Royal Fine Arts Commission.

The three buildings, the layout and appearance of which are



The relationship between London Airport's three new buildings is shown by the model at the head of this page; below it is a close-up, from above, of the passenger terminal, with its ten channels for travellers. On the right is a plan of the central area, showing the relative size of the buildings; the tinted portions are taxiways and aprons actually completed.

1. Control Building.
2. Passenger Handling Building.
3. Eastern Apex Building.
4. Staff Subways.
5. Vehicle Subways.
6. South End of Access Tunnel.

shown in the accompanying illustrations, are the control building, the south-east-face passenger handling building and the eastern apex building (housing various crew offices and public amenities). As indicated by the plan at the foot of this page they occupy only a part of the terminal area, so that ample room remains for further development. It was announced last week that the passenger handling building will accommodate domestic services only and that "long-haul" services will continue to operate from the temporary Bath Road building until a permanent building goes up—it is not yet known when—on the north-east corner of the central area. The Minister said that L.A.P. would eventually handle all London air traffic except in certain weather conditions and at the peak of the busy season (Gatwick will be the main alternative). The design and function of the new buildings, as envisaged in the M.C.A. plan, are summarized below.

The Central Area is bounded by an outer taxiway enclosing, on the north-east and south-east faces, two concrete aprons with capacity for 34 aircraft stands; these are arranged in two parallel rows on either side of an inner taxiway running straight through the centre of each apron. There are subways for coaches carrying passengers from the terminal building to the outer stands, and for pipes and tubes carrying the heating, electricity, pneumatic and other main services between the various buildings. The subway connecting the area with the Bath Road contains two separate 20ft carriageways, two cycle tracks and two pedestrian paths.

The Control Building, which dominates the area, is to the south of the centre of the inner terminal zone and faces the southern entrance to the Bath Road tunnel. All movements of aircraft and vehicles are controlled from this building, which will also house the airport management, aeronautical telecommunications and medical centre, restaurants and welfare facilities for all the staff in the area. The building is T-shaped with a 122ft 6in tower at the fulcrum; restaurants will be in the south wing and medical and administrative offices to the west. The main telecommunications services will be housed in the east wing. All control rooms will have false floors to permit maximum flexibility in the installation and maintenance of technical equipment. Below the glazed penthouse forming the aerodrome control room is the approach control room, 15ft high to accommodate a large information panel; a service floor will separate approach control from the ground movement control room.

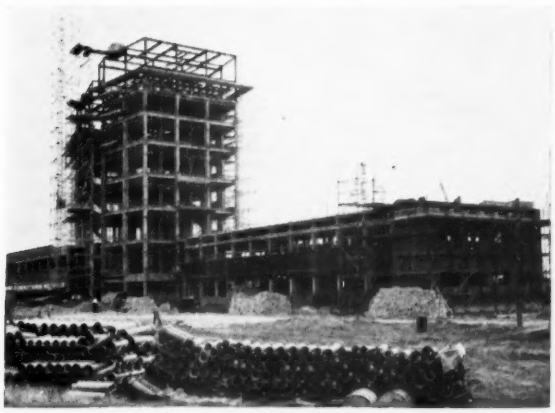
The South-east-face Passenger-handling Building accommodates, in addition to international, domestic and transit passengers, facilities for spectators' entertainment, storage of bonded spare parts, baggage stores and minor maintenance work on aircraft. "Processing" of passengers is concentrated entirely on the first floor of this building, which is planned as a series of transverse bands, containing, respectively (from land side to air side), the concourse, customs, immigration, health and waiting rooms. Ten parallel passenger channels cut through these bands at right angles. Each channel is self-contained and uninterrupted by cross flow, and the direction of passengers can be either inward or outward according to traffic demand.

The passenger arriving by airline coach passes directly into the correct channel at ground level and reaches the main concourse by escalator. His luggage is weighed and passed along ground-floor level by escalator, comes up to the first floor for customs inspection and emerges again at ground level on the air side of the building. There is a central entrance hall for the passenger arriving in his own car, who reports with his baggage to the airline counter for direction to the appropriate channel. The main concourse—the heart of the building—has airline counters, shops, post and cable offices, buffet and toilets at first-floor level; upstairs are a balcony lounge overlooking the concourse, a restaurant with lounge bar overlooking the airfield and additional shops, hairdressing saloons and cloakrooms. The bar is connected to the roof-garden "waving base," where passengers' friends and other spectators can watch aircraft departures.

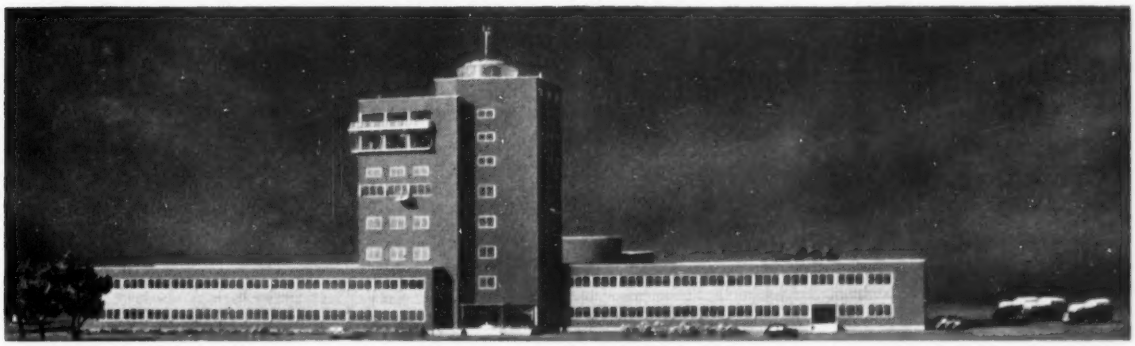
For transit passengers there is a self-contained suite on the air side of the customs barrier in the centre of the building at first-floor level. Domestic passengers, who are not required to pass through customs, immigration or health examinations, are accommodated in a separate section at the southern end of the building. On the ground floor, in addition to technical staff and equipment, are bonded stores and warehouses and two kitchens—one for the restaurants and one for the preparation of B.E.A. aircraft meals.

The Eastern-apex Building, midway between the two terminal buildings on the north-east and south-east faces of the central area, provides space for aircraft and crew clearance, including customs examination, aircraft load control, meteorological forecasting, flight planning and crew briefing. In addition, it will be the focal point for all spectators visiting the airport, replacing the present public enclosure which—although inadequate by modern standards, since it gives a very restricted view of airport activity—has proved such a popular feature. This building will give access to the roof gardens overlooking the entire parking area and will contain an exhibition hall, news cinema, grill room and buffet for the public. Opposite the public entrance (on the land side, facing west) will be placed the Alcock and Brown memorial designed by Mr. William MacMillan, R.A. The operational part of the building is completely separated from that section open to the public and contains, in addition to the facilities mentioned above, airline offices and crews' rest and dining rooms.

Construction of all three buildings is under the supervision of the Director-General of Works, Air Ministry. It is estimated that the control building will be completed in July 1955, although the tower and the telecommunications wing should be functioning by autumn next year. The passenger building will be completed by September 1955, and the apex building by January the following year. The amount of traffic which can pass through the present temporary buildings is expected to reach a peak next summer, and early in 1955 six channels of the new terminal building will be put into service. Most of the short-haul services will begin to use the central area in March of that year. M.C.A. expenditure on building works completed and planned at London Airport is estimated at £21m, of which £15m had been spent by March 31st this year. Of the total, the buildings account for a comparatively small proportion (some £3½m), and the architect has given an assurance that they will not cost more than the estimate.



Culminating in a glazed penthouse over 120ft from the ground, this building will be the heart of Europe's busiest airport, containing controllers, the airport management, telecommunications, medical centre, restaurants and welfare facilities. It is shown (left) as it appeared a month ago under construction and as it will be when completed in July 1955.



THE ACCOUNTANT

A Simple and Promising DC-3 Replacement Project

The Accountant's fine lines should be enhanced by the mirror-like skinning made possible by its system of construction. This is a photograph of a model which was on view at the S.B.A.C. Display.

IN *Flight* of July 31st there appeared an account of the tensioned-skin method of fuselage construction developed by Mr. L. C. Heal of Aviation Traders (Engineering), Ltd. As we then stated, this enterprising company is now in the process of designing an aircraft specially to take in the fullest advantage of the many benefits which this system offers. The conception is for an adaptable medium-sized transport powered by two Dart turboprops and designed to be, in Mr. Heals' words, "a common-sense, maid-of-all-work transport—space reserved for essentials only."

Right from the start, the design has been planned for mass production and is, therefore, eminently orthodox in character and aerodynamic layout. Fundamental advantages of the new structure are reduced cost, improved appearance and a saving in weight. It was recently estimated by a reliable source that "if a designer can reduce the basic weight of a design by 100 lb, then he is supplying the operator with an extra £2,700 a year in revenue." This estimate—which, of course, must depend on utilization and many other factors—was based on an assumed cruising speed of 200 m.p.h., so presumably a faster transport would reap yet greater benefits.

Unlike other recently announced projects in this class, the Accountant (the name is intended to underline the financial economy inherent in its manufacture and operation) is a low-wing aircraft. Aviation Traders consider that the low-wing arrangement offers increased safety from the point of view of impact and flotation qualities, as well as offering some benefits in ease of servicing and reduced undercarriage weight. It will be cheaper to buy than its competitors—again to quote Mr. Heal—"partly because of the method of construction and partly because there is less of it to buy." Actually the company are basing their calculations on a provisional selling price of £80,000, less radio.

The fuselage is, of course, of the type of construction detailed in our issue of July 31st. The only factor modifying the simplicity of the basic circular-section hull is the fact that the entire nose and cockpit has been arranged to hinge to starboard. As in the Airspeed Horsa 2 transport glider, this arrangement permits the loading of exceptionally bulky freight, such as boxed equipment measuring 4ft 3in × 4ft 6in × 26ft, or two family cars. One of the practicable features of the design is the manner in which a tractor and cable can be used to load such cargo, as shown in the accompanying drawing. During such an operation, passenger seating could be folded against the curved sides of the interior and no loading personnel would be required inside the fuselage at all, except for finally lashing down.

The folding nose, of course, poses some problems in the design of the control systems, but simple solutions have been found. Pivoted levers, fitted on both the nose section and fuselage, automatically intermesh when the nose is closed. In flight, the nose is pressure-sealed by a continuous Dunlop sealing ring, and the weight of the folding structure is supported on shear-carrying dowels attached to the heavy end-frames.

The floor is stressed to take loads of 150 lb/sq foot and, with the seats folded and toilet fitted, the space available for freight exceeds 800 cu ft. When the aircraft is used as a passenger transport, from 22 to 33 rearward-facing seats will be fitted, in rows of either three or four at a pitch of 38in. For mixed-traffic work, a movable bulkhead can be fitted at any of a number of frame stations.

ACCOUNTANT
(Two Rolls-Royce Dart RDa.3s totalling 3,080 e.s.h.p.)

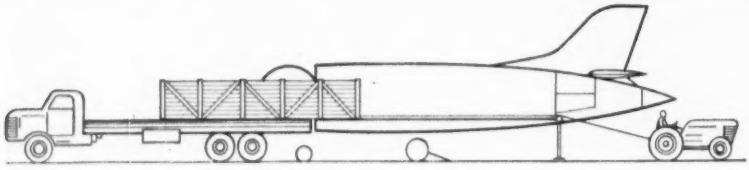
Dimensions	
Span	64ft 6in
Length	55ft 6in
Height at fin	22ft
Height to top of fuselage at wing	12ft
Total length of flat, level floor	38ft
Cabin length	28ft 8in
Cabin width at seats	7ft 5in
Cabin height	6ft 3in
Cabin and toilet volume	1,250 cu ft
Wing area, flaps up	500 sq ft
Weights	
Basic equipped weight	12,000 lb
Disposable load	9,000 lb
Initial all-up weight	21,000 lb
Wing loading (21,000 lb, no flap)	42 lb/sq ft
Power loading (21,000 lb, full power)	6.88 lb/e.s.h.p.
Performance*	
Max. continuous cruising speed (20,000ft and 13,600 r.p.m.)	295 m.p.h. T.A.S.
Stalling speed (19,000 lb, flaps up)	100 m.p.h. T.A.S.
Stalling speed (19,000 lb, flaps at take-off)	88 m.p.h. E.A.S.
Stalling speed (17,000 lb. flaps at landing)	68 m.p.h. E.A.S.
Sea level rate of climb (max. cont. power, 21,000 lb)	1,830ft/min
Rate of climb at 30,000ft (max. cont. power, 21,000 lb)	310ft/min
Rate of climb with one engine out (at 1,500ft, 21,000 lb, no flap)	392ft/min
Time to 30,000ft (max. cont. power)	30 min
Fuel used to 30,000ft	80 Imp. gal
Specific range (25,000ft at 13,300 r.p.m.)	0.291 stat. miles/lb fuel
Max. stage-length (full reserves, 25,000ft at 13,300 r.p.m.)	920 st. miles
Ceiling (100ft/min climb, 20,000 lb)	35,000ft
Take-off to 50ft (sea level, 21,000 lb)	2,130ft
Landing from 50ft (21,000 lb)	1,890ft
Balanced field-length (sea level, 21,000 lb)	3,300ft

The Accountant is stated to meet all B.C.A.R. 1951 requirements at 21,000 lb, including single-engined preliminary approach climb gradient [I.S.A.+15 deg C, 1,500ft] at the realistic weight of 20,500 lb.

Operating Economics: The S.B.A.C. method of obtaining direct costs has been closely followed, with the following fuel reserves and allowances taken into account in the computation of stage-lengths: diversion of 230 st. miles at cruising height; one hour stand-off at cruising height; zero wind; allowance of 150 lb to cover landing, taxying and unusable fuel; and an allowance of 5 per cent of total fuel load. Based on an annual utilization of 2,000 hr, with a stage-length of 920 miles, and cruising at 30,000ft at 288 m.p.h., the costs are assessed at: minimum cost per passenger statute mile, 1.04 pence; minimum cost per aircraft mile, 24 pence; minimum cost per aircraft flying hour, £26 10s.

**International Standard Atmosphere, estimates confirmed by R.D.A.C. branch of M.o.S.*

One particularly interesting feature is that completely serviced nose sections—including, of course, the crew compartment and all instruments and radio—could be kept in stock in an airworthy condition for C. of A. renewals and exchanged for a time-expired unit when necessary. A flight crew of two is foreseen, with a third crewman provided for. The windscreen, which is 18in in front of the pilot's eyes, has glycol sprays and wipers, and from it each member of the crew can see both wing tips and the ground 40ft ahead of the aircraft. Blister side-panels also permit vision almost straight downwards. Abaft the hinged nose, the usable volume is 1,620 cu ft and it is com-



Behind the rear pressure bulkhead, a pulley and cable fairlead permit the adoption of this neat method of loading bulky freight. The dimensions of the boxed equipment shown are 4ft 3in x 4ft 6in x 26ft. Procedure is described above.

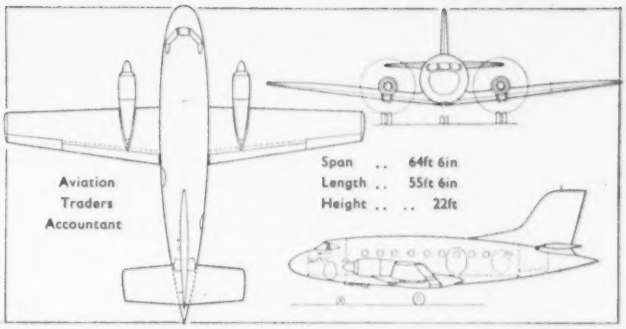
pletely free from obstruction over a level throughout its length. A hinged door with integral steps is provided on each side of the rear fuselage for passengers and for luggage loading.

Of conventional section producing gentle stall characteristics, the wing is provided with efficient area-increasing double-slotted flaps. In the interests of simplicity and weight-saving it is made in two parts, joined on the aircraft centre-line and attached to the maximum-diameter section of the fuselage by four accessible bolts picking up on double heavy-gauge fuselage frames.

The two Dart RDa 3 engines are conventionally mounted and their jet pipes are jacketed to provide hot air for de-icing and heating. All the fuel is carried in well-ventilated integral tanks mounted outboard of the engines. The total normal capacity is 540 gallons of kerosine, which can be augmented by two wing-tip tanks or a fuselage tank for long-range ferrying. Fin and rudder areas are adequate to ensure full control under engine-cut take-off conditions, whilst the volume of the horizontal tail surface approximates to 1.0.

The undercarriage is a straightforward tricycle type, the three twin-wheel units being interconnected and actuated by a single pneumatic jack. No undercarriage fairing doors are fitted, since these double-curvature units would demand considerable expenditure and attention in service for but slight gain in performance on a medium-range aircraft of this type. The oleo-pneumatic units are assisted by gravity and slipstream during lowering. Tyre pressure is less than 70 lb/sq in, which should be perfectly satisfactory for operation from semi-prepared surfaces. The tail-to-ground clearance angle is 12¾ deg and a spring tail-bumper is fitted to strong frames in the rear fuselage.

Altogether, the Accountant appears an unusually practical and straightforward aircraft, having many obvious applications in both civil and military fields. Built-in provision for full pressurizing to a differential of 6½ lb/sq in (8,000ft cabin altitude at 30,000ft), combined with ample seat spacing, should provide its occupants with very quiet and comfortable flying, of the standard now restricted to much more expensive machines such as the Viscount and Britannia. Aviation Traders (Engineering), Ltd., —whose offices are at 15, Great Cumberland Place, London, W.1 —are now starting work on a prototype; the simplicity of construction suggests that the usually lengthy process may in this case be considerably shortened.



SMALL-HELICOPTER DEVELOPMENT

A French Operator's Viewpoint at Helicopter Association Meeting

AS we recorded last week, the privilege of opening the 1953-54 lecture season of the Helicopter Association of Great Britain fell to Commandant H. Boris, M.B.E., whose paper entitled "Problems Associated with Small-helicopter Development" was presented on September 11th. A digest, and notes on the discussion, are given here.

INTRODUCING the lecturer, Mr. Eric Mensforth, C.B.E., President of the Association, said that Commandant Boris was the managing director of Helicop-Air in Paris and had been associated with the operation of small helicopters in France and elsewhere for nearly four years. He had had a distinguished career; he had been awarded the Croix de Guerre and M.B.E. in recognition of his achievements in the military field, and was a keen supporter of sporting aviation as a pilot in light aircraft racing. His background of experience made him well qualified to speak on his subject.

Commandant Boris (speaking in fluent English) began by outlining the experience his company had acquired. They had, he said, accomplished some 8,700 flying hours on a variety of tasks. This included approximately 2,000 hours spent in training, 35 civilian and ten military pilots having been trained to date. Some 1,500 hours had been flown for publicity purposes, during which time over 60,000 people had ridden in their helicopters; 2,300 hours had been flown for passenger transportation in the south of France on short distances between Nice, Cannes, and other cities; and 1,500 hours were spent on agricultural work, mainly rape-seeding and in cockchafer destruction. (Some experiments had also been carried out on rice-seeding, and, in North Africa, some 300 hours had been used for spraying and fogging in mosquito-control operations; other pest-control operations had been undertaken in Morocco and Tunisia, involving several hundred flying hours.) Finally, as an example of the company's versatility, about 1,200 hours had been flown on such tasks as high-tension line and pipe-line survey, and the transportation of material in mountainous regions.

In view of this successful record of activity with small helicopters—the company is operating three-seater Hillers—why, the lecturer asked, was progress so slow in the development of the small machine? The first answer which naturally came to mind was the high cost of the helicopter, but he felt that this was only partially true. If the various operations were examined and an analysis made of the reasons which discouraged satisfied customers from buying a machine or continuing to use helicopter facilities, it was found that the following three points were always recurring: (i) Efficiency—the ability of the helicopter to perform in the most efficient manner the intended job. (2) Operating costs (initial cost naturally had a bearing on this question). (3) Maintenance.

Efficiency.—Firstly, the general principle of thinking of helicopter production in terms of fixed-wing aircraft production should be revised. The same type of helicopter had been trying to fulfil all the different kinds of duty. The time had come when, if extensive development was wanted, this general-purpose utilization must change. For agricultural work a three-seater was not required; thus the useful load could be increased by omitting many refinements. Conversely, an executive transport machine should not need to be fitted with agricultural attachments, and for mountain flying everything should be sacrificed for high-altitude performance.

Manfacturing a specific type of machine for each specific task was clearly an impossibility, but if it were possible to use the same basic frame as a helicopter chassis—thinking in automobile terms —this chassis could be equipped with different fittings and body configurations which would allow the operator to accept jobs which he could not otherwise carry out efficiently, and therefore economically.

As an example, one particular agricultural job which was undertaken by the company involved the dusting of a number of small, widely scattered fields. Due to the size of the fields, and to flying obstructions, the helicopter could be loaded to a maximum of only 300 lb. This meant that an average of 36 acres per hour could be treated which, at a rate of 15s per acre, was equivalent to a payment of £27 per flying hour. The average operator would have to log some 500 to 600 hours annually to make this profitable. Such a high utilization was difficult for an agricultural operator to achieve, and experiments were carried out to strip the machine of all unnecessary trimmings. By so doing it was possible to carry 400 lb of dust and treat 55 acres per hour. The equivalent payment per flying hour was thus increased from £27 to £41 and the work became a profitable undertaking.

Further examples showed that their three-seater helicopters, when used as executive transports, had insufficient range under certain conditions without auxiliary fuel tanks, the fitting of which reduced the payload to make the machine a two-seater. On the other hand, for flying-training purposes, the third seat was superfluous. The lecturer concluded that two basic types of small helicopter were required.

Operating Costs.—One important factor which adversely affected cost per flying hour was the high insurance premiums (22 per cent). The high initial cost of the helicopter was partly responsible for this, and here it was to be hoped that an ultimate increase in production would reduce initial cost. For the present time Helicop-Air were putting into practice a scheme originally mooted by Mr. Colin Cooper, whereby replacement parts needed after an accident would be invoiced at cost price, as also would be the labour charges for repair. This brought their rate of insurance down to 17-18 per cent and a further reduction could be effected if agreement could be reached with the manufacturers to work on the same principle.

The operating costs of the Hillers worked out at £30.5 per flying hour on the basis of an annual utilization of 300 hours, reduced to £14 per flying hour when the annual utilization reached 1,000 hours. Commandant Boris thought that for many uses (agriculture, flying training, publicity, etc.) annual utilization must be assumed to be low and that helicopters should

be designed so as to be profitable to the operator under such conditions. A small two-seater could adequately perform most of these functions, and for a small number of flying hours a jet-driven-rotor type would be the most economical (when hours increased above 500 per year fuel consumption altered the picture). Operating costs of a small jet-driven machine would be in the region of £18.7 per flying hour for a 300-hour annual utilization, using the estimated figures for the Hiller Hornet.

This type of helicopter, though flying only three or four months of the year, would be profitable to its owner.

Maintenance was the nightmare of most operators; although much had been done to improve the serviceability of present-day machines and increase the working life of component parts there was still room for considerable improvement. There was a necessity for closer collaboration between operator and manufacturer. At present it was necessary to employ one licensed mechanic per helicopter, but it was hoped that the situation could so be improved that a fleet of four aircraft could be serviced by two licensed mechanics and one helper.

Maintenance work should be so organized that machines were not grounded for inspection at a time when they should be engaged in revenue-earning. Most of the Helicop-Air maintenance was done at night, and overhauls were carried out progressively on a unit-replacement principle. This meant higher labour costs on the night-shift and a large capital investment to provide a comprehensive range of replacements, but it enabled the helicopters to fly 100 to 120 hours per month during the busy season and was more economical in the long run.

Conclusion.—The lecturer gave his views as to the types of helicopter which practical experience had shown would be profitable for an operator. They were: *Type A*: An efficient machine that could either carry a heavy load, be capable of a long range, or have good high-altitude performance; *Type B*: A small, easy-to-maintain helicopter.

Type A should have a piston engine of approximately 350 b.h.p. and should be built on the "chassis" principle, in a number of versions from a single seater to a four-seater according to the job required, and separate kits could be sold independently to equip the machine for its different functions. Preliminary calculations showed that the following loads could be expected: Weight empty, 1,750 lb; pilot, 170; fuel and oil (4 hours), 540; payload, 1,260; disposable load, 1,800; gross weight, 3,720 lb.

It was possible, further, to estimate performance figures. The hovering ceiling would be over 4,000ft without ground effect, and about 7,500ft with ground effect. The vertical rate of climb would be of the order of 900ft/min at all-up weight. Used as an agricultural tool, this helicopter, with one hour's endurance, would have a payload of 1,300 lb, taking the weight of agricultural equipment at about 100 lb. On executive-transport work, with two passengers plus pilot, the disposable load would still be 900 lb. which could be used for an auxiliary fuel tank, or for electrical equipment or, eventually, a hoist. Such a machine could be used in an overloaded condition if necessary, and would still have a good performance in tropical climates. The initial cost should not be very much higher than the present three-seater types, and operating costs would be approximately equal.

For Type B a Hornet-type helicopter seemed to be the answer, simply designed so that the initial cost was not more than £3,500 to £4,000. It should have an endurance of approximately one hour and a payload of 300 lb.

THE DISCUSSION

Mr. M. J. Brennan (Saunders-Roe) said that manufacturers needed a clear indication from operators as to the probable annual utilization if they were to produce a small helicopter which could be operated profitably. If the utilization were high then the flying-hour cost of a small jet helicopter would be disproportionately high, because of the excessive fuel consumption. In places like Australia the annual utilization of light fixed-wing aircraft was of the order of 1,500 to 2,000 hours; he wondered whether the helicopter would not eventually reach such a figure.

Cmdt. Boris, in reply, reiterated his opinion that the annual utilization of a small agricultural helicopter would be low. He cited the parallel case of a combine-harvester which, although it was probably used only for a month or less in the course of a year, was still a profitable investment for the farmer or group of farmers who owned it. In the small helicopter, payload was of greater importance than speed.

Mr. J. V. Roberts (Short Bros). said that we were at a disadvantage in Great Britain because of the lack of a suitable engine within the 200 b.h.p. to 500 b.h.p. range.

Dr. G. S. Hislop (Fairey Aviation) agreed with the lecturer's view that thoughts on helicopter production should run more along automobile lines. Automobile methods should be adopted to improve the life of component parts. He thought Cmdt. Boris had been somewhat optimistic in his estimate of a ratio of nearly 50 per cent disposable load to gross weight in his figures for a 350 b.h.p. machine, and he also thought a high cruising speed essential for an executive transport.

Mr. J. Shapiro (consultant) thought that the principle of building a "chassis" was a good one. In addition, a more realistic approach was required on the question of airworthiness. The present attitude assumed that a proposed helicopter was unairworthy until it had been proved to be airworthy by flying many thousands of hours.

Mr. F. L. Hodgess (Fairey Aviation) asked what attributes, in the lecturer's view, a helicopter should have to enable it to fulfil a task requiring a high payload and slow speed in a locality perhaps 1,000 miles from its normal base.

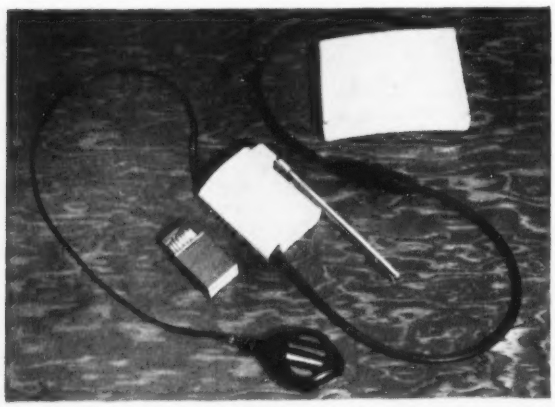
Mr. A. E. Bristow, requesting permission to answer this question, stated that the best and most economical method of transporting a light helicopter for long distances was by road.

Mr. Alex A. Reichel (Sweden) suggested that for light helicopters the piston-engine should be abandoned in favour of jet-driven rotors.

Cmdt. Boris, replying in conclusion, said that although he had no particular love of the piston-engine he thought it would remain the most economical form of propulsion in a long-range helicopter for many years to come. As regards the small agricultural machine, he was glad to have support for his view that jet-driven rotors would provide the answer.

"TALBE" RESCUE EQUIPMENT

IN our notes (September 18th) on the radio exhibits at Farnborough, brief reference was made to the new V.H.F. beacon and R/T. transmitter/receiver called TALBE (talk-and-listen beacon equipment) designed by the Vidor Burndept Group, of Erith, Kent, for use in search-and-rescue operations. It is now possible to publish an illustration of the equipment, which, consisting of three compact units, is small enough and light enough (2 lb) to be carried in a Mae West. The beacon is designed for operation in conjunction with the standard V.H.F. homing equipment installed in search aircraft and naval vessels. It automatically transmits a distress signal for six hours as soon as the telescopic aerial is extended, and the signal can be picked up at 50 miles at 5,000ft. Two-way R/T. communication can be maintained for a minimum of 30 minutes, and at a range of over 20 miles. The three units consist of the beacon and R/T. transmitter-receiver, 1.34v battery, and microphone/loudspeaker.



The three "TALBE" units compared in size with a matchbox.

LONDON NAVIGATION EXHIBITION

THE Science Museum, South Kensington, announces that it has been decided to keep the exhibition "Navigation Today" open until January 17th next. This special collection shows the various types of instruments and equipment at present used in navigation —in the air and on land, as well as at sea—including radar and other radio aids. Many of the exhibits are arranged for operation by visitors and there are other working demonstrations of navigational methods. The museum is open on weekdays from 10 a.m. to 6 p.m. and on Sundays from 2.30 to 6 p.m. Admission is free.

PRACTICAL MAPS

RECENT issues of "Foldex" maps include *Benelux* (Holland Belgium and Luxembourg, in one, two or three sections in the same cover, as required), scale 1:400,000, legends in Dutch, French and English; *Germany* (northern, southern or both sections in one cover), scale 1:1,000,000, legends in English, Danish, Dutch, French and Italian; and *L'Ile de France, or 120 km round Paris* (one section), scale 1:150,000, legend in French. Moderately priced, all these maps incorporate a patent method of folding which enables them to be opened at a particular section without unfolding the whole map. Though primarily for the road-user, they give a great deal of general information; in some, for example, airfields are shown with a distinctive mark indicating whether they are military or civil. The publishers are Foldex, Ltd., 45 Mitchell Street, London, E.C.1. (Clerkenwell 0711).

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Extract from the Statement by the First Lord of the Admiralty explanatory of the **NAVY ESTIMATES, 1953/54.**

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WYVERN SQUADRON

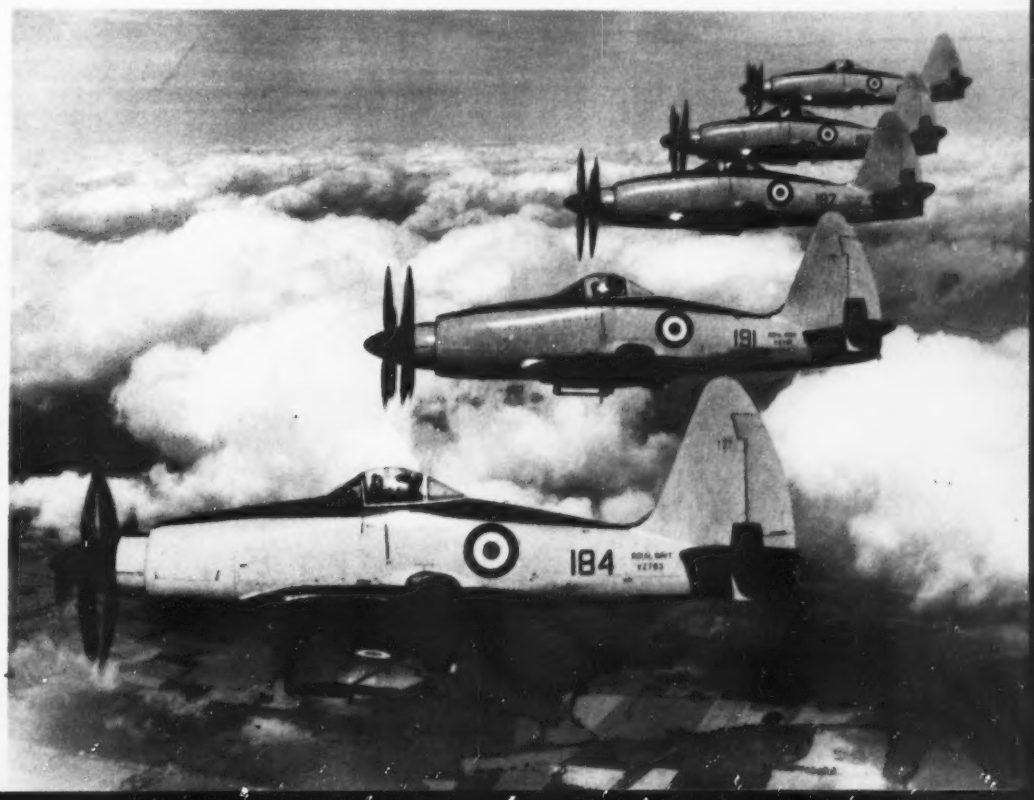
A Famous Naval Unit is Re-equipped

By JOHN YOXALL

THE first Naval unit to have the Westland Wyvern strike aircraft is No. 813 Squadron, stationed at R.N. Air Station Ford, on the Sussex coast. At the close of the recent exercise "Momentum," in which their rôle was to attack the coastal convoys, an hour's flying was devoted to posing the new aircraft above the clouds; that they made admirable sitters for these *Flight* portraits will be apparent from the following pages.

No. 813 Squadron, R.N., was first formed at Gosport in January, 1937, under the command of Lt.-Cdr. C. R. V. Pugh. It was equipped with Fairey Swordfish, a type which it retained throughout the war period.

The squadron's first carrier was H.M.S. *Eagle*, and this association was maintained until the ship was lost in the Mediterranean in August, 1942. Only one month was allowed for working up before embarking in *Eagle*, which then sailed to the China station. When war broke out in September, 1939, her base was changed to Ceylon, and from here trade protection patrols and raider searches, carried out over wide ocean areas, occupied the next seven months.



(Above) Beside one of the Westland Wyverns they fly and maintain are the pilots and ground crews of No. 813 Squadron R.N. The pilots are, from left to right, Lt. Macfarlane, Cmmd Plt. Keatley (who flew the photographing Meteor 7), Lt. Lawrence, Lt. Thompson, Lt. Threlfall, Lt. Gregory, Lt. Farthing, Lt-Cdr. Price (Commanding Officer), Sub-Lt. Cooper, Lt-Cdr. Genge (Senior Pilot), Lt. Harper, Lt. Cracknell and Cmmd Plt. Gee. (Right) Echelon to starboard, stepped up. A pretty piece of formation flying—even for the Fleet Air Arm.

WYVERN SQUADRON . . .

This hard-working sojourn in the Indian Ocean ended with a refit in Singapore and the Mediterranean Fleet was joined on May 28th, 1940. Four Gloster Gladiators were added to the squadron strength as a fighter component.

The score was soon opened with the Gladiators shooting down two Italian bombers and the Swordfish sinking one destroyer and one merchant ship. Bombing attacks were made on coastal targets in the Western Desert.

After some ten months in the Mediterranean, No. 813 flew ashore to Port Sudan and operated against the Italians from landing fields in the Red Sea area. They were immediately successful: between April 3rd and 8th, 1941, no fewer than three Italian destroyers were sunk by bombing.

Re-embarked in *Eagle*, passage was made to the South Atlantic where, based on Freetown, operations against the German supply ship *Elbe* were instituted. She, also, was sunk by bombs.

The airfield at Freetown was never good, and during the rainy season it approached the impossible. One who was there recalls the conditions prevailing. "Before taking off," he says, "it was necessary to get rid of crowds of very interested natives, all carrying large umbrellas. The aircraft was then run-up to full throttle

on the compass base, the only bit of hard ground on the field. On releasing the brakes the aircraft slithered downhill towards the sea, crossing a small stream in the process. On landing, a high taxying speed was maintained in order to remain on the top layer of mud. About 48 natives were employed, all in uniform, to lift out the unfortunate aircraft that sank too far. Diversion was provided by the rigid training of these natives, who saluted everything in sight, including the pilot of the aircraft they were about to rescue. Another diversion was the rather primitive convenience, a long stick being kept some distance away from this three-sided lean-to. Before entering it was advisable to poke round all the corners to disturb any snakes which were vying quite strongly for possession of this desirable residence."

Having had nearly five years abroad, in October, 1941, the squadron was disembarked at desolate Macrihanish, Kintyre. It was again equipped with nine Swordfish, but this time had two Sea Hurricanes as the fighter component in place of the Gladiators. The latest embarkation in *Eagle* was made for anti-submarine and convoy operations in the Mediterranean and it was just chance that when *Eagle* was lost the squadron was disembarked at Gibraltar. Until the end of 1943, when the unit's tour of duty in the Mediterranean theatre of war ended, No. 813 operated

Photographic opportunity of a lifetime: Pictures of No. 813 Squadron that combine to depict the elegance and manœuvrability of the Westland Wyvern and the skill of the pilots. The underside plan-view was taken as the Commanding Officer turned away on completion of the photographic sortie.

The Commanding Officer, Lt-Cdr. C. E. Price, brings his Wyvern S4 alongside the Meteor 7 to be photographed.

WYVERN SQUADRON . . .

from the North African airfields at Algiers, Bone and Taparoni.

The long spell of duty in tropical and sub-tropical seas came to an end, and the squadron was next re-formed at Donibristle for convoy escort work over the Atlantic and Arctic Oceans. It was embarked in H.M.S. *Campania* in April, 1944, and had on strength 12 Swordfish, four Wildcats and three Fulmar night-fighters, the last-named type being used against night shadowers on the convoys to Russia. It is said that the array of aerials sported by these Fulmars had to be seen to be believed. Two successful Atlantic convoy escorts were followed by a Russian convoy in September and a covering operation for one of the Norwegian coastal attacks which were then taking place. Six days before Christmas the Wildcats shot down two German aircraft and the Swordfish sunk four submarines. This, as the squadron diary of the time relates, was most gratifying to the unit even if the Russians didn't believe it.

In January, 1945, six Swordfish were embarked for anti-submarine duties in a Norwegian coastal sweep and for this operation the fighter strength was built up to eight Wildcats. February was spent in shepherding yet another Russia convoy, and during a short rest at Macrihanish in the following month the last of the Fulmars was flown ashore and the night-fighter flight disbanded.

The squadron's final operation of the war was carried out from H.M.S. *Vindex*. This was No. 813's fourth Russia convoy, an assignment which was completed only two days before V.E. Day. So ended a difficult and thankless task.

The winter weather conditions between North Cape and Spitzbergen had been appalling. Owing to the short days of pallid half-light most of the flying was done in the dark. Two-hour trips in open cockpits had to be endured, with landings on heaving, ice-covered decks at the end; then the crews had to be lifted from their cockpits and taken below for warmth and to stand-by for the next patrol.

Four days after V.E. Day No. 813 Squadron was disbanded. It was re-formed in September, 1945, at Ford, with 15 Mk 4 Blackburn Firebrands. This was the first time that the unit had been in England since its original formation eight years earlier.

Peacetime history has followed the familiar pattern of Home Fleet squadrons. The unit has been embarked in both *Implacable* and *Indomitable* and has taken its part in innumerable exercises, air days and fly-pasts. Visits have been made to Stockholm and to La Linea, Spain. The Firebrands gave place to the Westland Wyverns in May of this year. The crews certainly seem happy enough with their new equipment and the Armstrong Siddeley Python turboprops (3,670 s.h.p. plus 1,180 lb thrust)—a far cry from the 690 h.p. of the Swordfish.

COMMANDING OFFICERS

Jan., 1937	Lt-Cdr. C. R. V. Pugh	Sept., 1945	Lt-Cdr. R. Lee-White
Mar., 1938	S/L. E. G. Forbes	May, 1947	Lt-Cdr F. W. Turney
Sept., 1938	Lt-Cdr. N. Kennedy	Dec., 1947	Lt-Cdr. C. R. J. Coxon
June, 1941	Lt-Cdr. D. H. Ellis	Aug., 1948	Lt-Cdr. C. K. Roberts
Nov., 1941	Lt-Cdr. A. V. Lyle	Mar., 1949	Lt-Cdr. J. M. Henry
Aug., 1942	Lt-Cdr. C. Hutchinson	Sept., 1950	Lt-Cdr. R. S. Abbott
Oct., 1942	Lt-Cdr. A. H. Abrams	Oct., 1950	Lt-Cdr. J. S. Barnes
Dec., 1943	Lt-Cdr. J. R. Parrish	Mar., 1951	Lt-Cdr. L. W. A. Barrington
Sept., 1944	Lt-Cdr. C. A. Allen	Feb., 1952	Lt-Cdr. A. D. Corkhill
Jan., 1945	Lt-Cdr. S. G. Cooke	Mar., 1953	Lt-Cdr. S. S. Laurie
		July 1953	Lt-Cdr. C. E. Price

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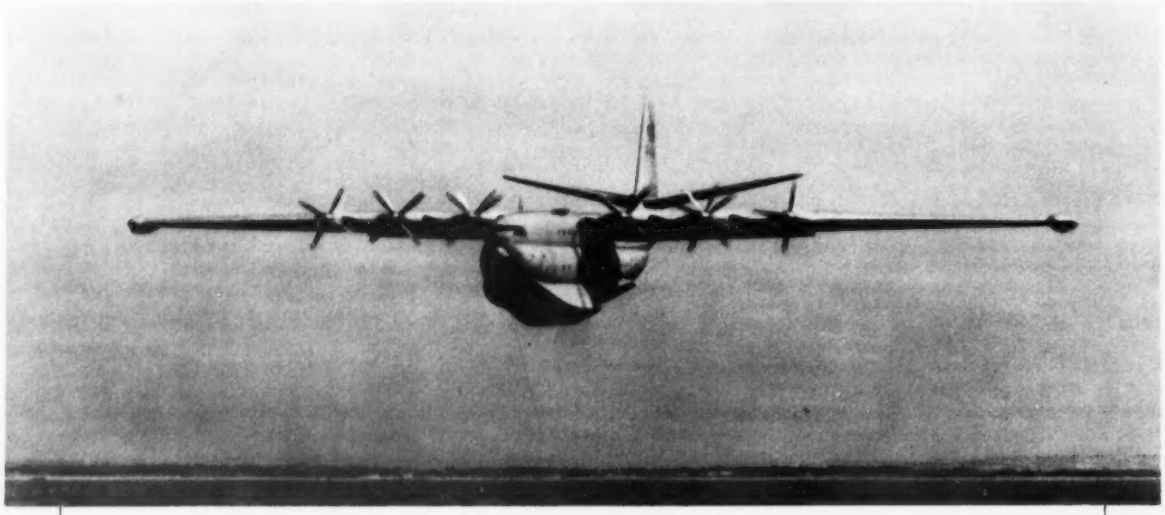

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THE ANGLO-AMERICAN CONFERENCE

The Opening Ceremony: A Varied Programme of Lectures and Discussions

THE 1953 Anglo-American Conference was formally opened on the morning of Tuesday, September 15th, in the main hall of the Friends' House, Euston Road, London. After a short welcoming address to the delegates by Professor Lloyd Evans (on behalf of University College), Sir William Farren, president of the Royal Aeronautical Society, welcomed to London the American delegates from the Institute of the Aeronautical Sciences, and read a message to the conference from Her Majesty the Queen. In a brief speech, Mr. C. J. McCarthy (president of the I.A.S.) thanked the host society for its welcome and read messages of greeting from the President of the United States, the Secretary of the U.S. Navy and the Secretary of the U.S. Air Force.

Giving details of the conference, Sir William Farren stated that a record number of over 700 delegates had enrolled, including over 150 from the U.S.A. The number of papers to be presented this year (twelve) was smaller than in the past, in order to reduce the number of days taken up by the conference (and so enable more delegates to attend), to have as few papers simultaneously presented as possible, and to give the maximum time for discussion. A provisionally arranged thirteenth paper, *A Family of Delta Aeroplanes*, by Mr. S. D. Davies (chief designer of A. V. Roe) had had to be withdrawn, continued Sir William, due apparently to security reasons. The president concluded by paying a tribute to the Society's Secretary, Dr. A. M. Ballantyne, who had been responsible for a great part of the conference organization, including the production of the excellent conference handbook. We give below, and on the following pages, summaries of the first three lectures and discussions.

STRUCTURES FOR HIGH-SPEED AIRCRAFT

By H. L. HIBBARD and J. F. McBREARTY

(Respectively vice-president engineering and chief structures engineer, California Division, Lockheed Aircraft)

MR. HIBBARD began the lecture by referring to its three sections, which dealt respectively with structural problems in high-performance aircraft, structural methods for the solution of these problems, and structural materials available for their solution. The lecturer then called attention to the imposing fraction of an aircraft's total weight that consisted of structure weight alone (see Fig. 1), and to the severe performance penalties resulting from relatively small increases in gross weight.

The first main structural problem dealt with was that of the effects of elevated temperatures, due both to aerodynamic heating and to thermal radiation from atomic weapons (a known probability in the future). The effects to be studied included the material's "hot" strength during and after long exposure, its weight strength after exposure, its corrosion protection and its creep properties. In addition, effects on the structure included distortion of aerodynamic contour due to non-uniform heating, strength and stiffness under non-uniform heating, and overall strength and stiffness at high temperatures.

A considerable amount of data was available so that, in general, account could be taken of the change in physical properties of the material at elevated temperatures. In spite of the range of high-quality materials available it remained true that at higher temperatures, other things being equal, the structure must be heavier than would be necessary and sufficient for normal temperature environment.

One new aspect of airframe structural design would come with the advent of nuclear-powered aircraft. It was known that many materials suffered damage, mainly with respect to fatigue properties, when exposed to a radiation flux and many became themselves highly radioactive under the same exposure. Concerning structural design, there were four new considerations. Remotely controlled service and maintenance procedures would probably be necessary; since large fuel loads would not be carried in the wing, there would be little bending relief there; heavy shielding for crew quarters would emphasize the requirement of dynamic vertical bending response of the fuselage; and finally, as take-off weight and landing weight would be very nearly the same, the landing gear and supporting structure would not be afforded the weight-saving that was previously available.

The phenomenon of structural fatigue had become an increasingly important problem in aircraft design. This was due to the steady reduction of conservative factors in design, the increased utilization of modern aircraft in terms of service time and loading, and to the exploitation of new and stronger materials. The improved static properties of the new materials and alloys were not accompanied by a proportionate improvement in the fatigue properties. Fabrication methods which produced appreciable residual tension stresses were being avoided by various means to reduce fatigue difficulties, and meticulous stress analysis and fatigue testing of complete critical structures were becoming general practice.

Another problem was that of structural rigidity. In the past, aircraft structures had generally been designed for specified strength levels, and the resulting stiffness had usually been adequate. Higher speeds, thinner wings, stronger materials and more refined design, however, had brought with them the need for more attention to stiffness considerations. One of the undesirable effects of flexibility was reduced aileron effectivenes due to the adverse twisting of the wing by the aileron loads, which resulted in the extreme case in aileron reversal. Another phenomenon accompanying higher speeds and more flexible structures was divergence.

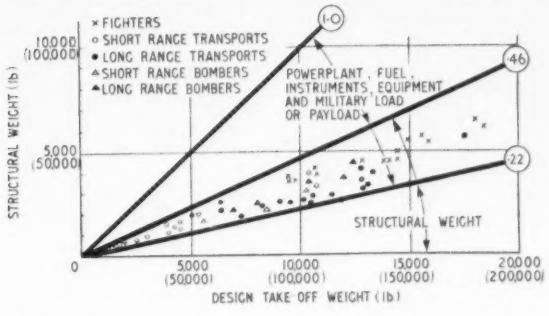
Additional stiffness was therefore often necessary, and resulted in the problem that, whereas in providing maximum strength for minimum weight, the stress should be everywhere constant and large, this did not apply in the case of design for a maximum stiffness/weight ratio. Strength was always a requirement, but the stiffness criterion must not be overlooked.

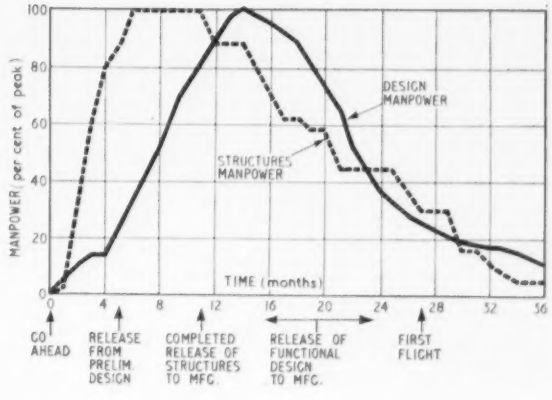
There was also an important class of phenomena involving structural flexibility where the rate of deformation with time was the significant factor. For some types of aircraft, such as large transports and bombers, it was believed that these dynamic effects would become of increasing significance.

The most important ingredient in a successful design was, of course, manpower. It had been found from experience that specialized groups were required to cope effectively with the problems of aerodynamics, flutter, materials, mechanisms, etc., and the structure was no exception. In one example, the work of a specialist structures group had reduced the number of practical combinations of wing design conditions to be pursued from 2,400 to 17. The number of structural personnel should reach a peak early in the design stage, and the ratio of stress engineers to designers and draughtsmen should subsequently vary (see Fig. 2) for optimum results.

The use of mechanical and electrical computors had made practicable for routine use technical methods previously out of the question due to the sheer quantity of calculations

Fig. 1. (Below) Structure-weights of various types of current aircraft. These are seen to lie between 22 and 46 per cent a.u.w. Fig. 2. (Right) Utilization of structural manpower. In this arrangement the structures personnel numbers should reach a peak before those of the design staff.





ANGLO-AMERICAN CONFERENCE . . .

required, Mr. Hibbard continued. The latest IBM defence calculator could perform some 1,900 equivalent computations per dollar, compared with approximately 100 with electric desk calculator or punched card system, and 50 with slide rule. It was believed that in the not-too-distant future it would be possible to "design" a complete structure quickly in a machine.

Another development that was removing much of the guesswork from airframe design was the accurate measurement of structural loads in flight and in landing, and the use of this technique was becoming increasingly an integral part of aircraft development. One useful and economical method was the use of high-velocity aircraft rockets on which were mounted small scale structures (e.g. wings), ciné cameras and telemetering equipment.

Turning to structural test methods in the laboratory, the lecturer described the phenomenal increase in manufacturers' testing facilities during the past 50 years. The problem of safe pressure testing of high-altitude aircraft was important; one Lockheed method featured the use of large paperboard cylinders and foamed plastic "bricks", filling the fuselage.

The lecture's third section concerned structural materials. After tracing the historical development of the principal aircraft structural materials over the past 50 years, Mr. Hibbard showed the distribution by weight of the main materials in a current American fighter aircraft. About 75 per cent of the structure itself was aluminium alloy, amounting to some 33 per cent of the total empty weight.

The new aluminium alloy 78 ST was next described by the lecturer. A comparison of its properties with those of other alloys was given (see table above). It was expected that the compressive properties of 78 ST would provide the greatest structural gain.

The development of the integrally stiffened structure, although not strictly a material development, was next described. Reasons of simplification, low weight, high-strength structure, higher loads and more compact structures had favoured this technique. As an example, the lower surface of the inner wing box beam on the Super-Constellation, composed of three pieces 38ft long machined from 75 ST plate, resulted in a 17 per cent decrease in weight, and required only 19 per cent of the parts, and less than 18 per cent of the rivets, screws, bolts, etc., compared with the conventional structure of sheet, extruded stiffeners and local reinforcing.

Recent experimental work had been performed on S.A.E. 4340 steel at the highest level at which it could consistently be tempered (260,000 to 280,000 lb/sq in). This work showed that the reduction in ductility and impact was not excessive, and that there was a larger spread between yield and ultimate tensile strengths, which was helpful in stress redistribution. This "high heat treat" steel promised to afford substantial gains in bending and tension applications and, as loading intensities increased, and structural space decreased, applications of the material in compression structures also were likely to prove efficient.

One material which offered much to the solution of the problem of providing strength/weight efficiency at high temperatures was Titanium. Having remarkable resistance to corrosive attack and excellent high-temperature properties, it was a highly attractive structural material. A comparison of specific strength variation with temperature for Titanium and other alloys was then given by the lecturer.

There was much scope for plastics in the aircraft structure, and much progress had been made in this field. Non-crazing thermo-setting plastic canopies with quite high critical temperatures had been successfully formed and laminated, and laminated thermo-plastic canopies had been made. Strong, lightweight cores for sandwich construction had been developed from laminated cellulose products, and from foam plastics.

The array of materials at present available to the structural designer had never before been equalled. For the future, important developments were being made leading towards the exploitation of still other materials such as ceramics. Nuclear physics revealed that materials as we knew them at present consisted mostly of empty space, while the nucleus itself was packed with mass at the fabulous rate of about two billion tons per cubic inch, so that untold strengths might one day result when the secrets of atomic binding were better understood.

Comparison of Minimum Properties of 24ST, 75ST, and 78ST Aluminium Alloy Sheet

Property	24S-T3 Alclad	75S-T6 Clad	78S-T6 Clad	Per cent increase of 78S compared with:	
				24S-T3	75S-T6
Tensile ultimate (p.s.i.) ...	60,000	70,000	75,000	25.0	7.1
Tensile yield (p.s.i.) ...	45,000	61,000	67,000	48.9	9.8
Compressive yield (p.s.i.) ...	37,000	62,000	66,000	78.4	6.5
Per cent elongation in 2in...	12	7	7	—41.7	0

The authors concluded that the aircraft designer had powerful tools available to secure efficient, safe and practical structures for high-speed aircraft, and that these structures could indeed keep pace with the expanding knowledge of the science of flight.

The discussion on the paper was opened by DR. P. B. WALKER (R.A.E., Farnborough) who maintained that, although aerodynamic distortion was important, the loss in strength of materials was the main factor when flight at high temperatures was considered. Concerning the fatigue problem, although accurate prediction might be impossible, the limited knowledge of static strength also should be realized. DR. A. E. RUSSELL, of Bristols, referring to the increased use of automatic computation in stress calculations, pointed to the novel possibility that in the case of an expensive mistake it would no longer be found that the perpetrator had since left the company. Machined integral construction was indeed more efficient than previous methods, but, using up to seven times as much basic raw material, was it really cheaper, he asked.

Further references to work on nuclear and heat topics was requested by MR. R. H. SANDIFER (Handley Page), who went on to state that Titanium could not be used fully to save weight, as its specific stiffness was no better than that of aluminium alloys. He thought that water-submerged pressure testing was safer than the American technique. MR. E. D. KEEN, of Armstrong Whitworth, believed that more work on structures was necessary in the project stage, i.e., even earlier than had been suggested.

This year's Wilbur Wright lecturer, PROFESSOR N. J. HOFF, after paying a tribute to the past record and present achievement of the lecturer, expressed his satisfaction that the problem of atomic propulsion was being actively tackled. Would it not be permissible, he enquired, to use materials of some five to six per cent creep per hour for short-term use, e.g., in missiles?

The use of computing machines was very important in saving work, affirmed DR. T. P. WRIGHT (I.A.S.), while the main advantage of the machined integral construction was the large reduction effected in the number of parts. He hoped that progress would not be slowed down by excessive security restrictions. Time was insufficient to allow all the pre-notified discussion contributions to be made, or the lecturer to reply, but among the remaining speakers from the floor was MR. S. D. DAVIES (A. V. Roe), who enquired whether a full series of the results of the in-flight measurement of wing bending moments, mentioned by Mr. Hibbard, was available.

POD MOUNTING OF JET ENGINES

By GEORGE S. SCHAIRER

(Chief of technical staff, Boeing Airplane Company)

THE lecturer began his dissertation by discussing the aerodynamic performance of an aircraft, basing his remarks principally upon the well-known Breguet range formula. He argued the case for wings of increased aspect ratio, and reduced the problem to comparisons of lift/drag ratio, critical Mach number and basic engine performance. With regard to the latter, he pointed out that engine performance could be materially changed by the features of a particular installation, and claimed that pod mounting gave the possibility of negligible inlet and tail pipe losses.

Tunnel testing of isolated pod installations could be made to determine that there were no separations over the nacelle, and that the critical Mach number of both the forward and aft portions of the pod (these had to be determined separately) were adequately high. Almost any basic pod arrangement could be developed with a critical Mach number in excess of 0.9, and Mr. Schairer felt that his company's experience indicated that flat plate drag was the only function to be assessed in determining the aerodynamic performance. In smoothing out the airflow at high angles of attack, properly designed pods could confer greater benefits than any combination of fences or slots that Boeing had studied, and further advantages accrued from the reduction in wing bending moments as compared with an aircraft employing engines buried at the wing roots.

Safety, however, was the greatest consideration which had led Boeing to adopt the nacelle-mounted engine. Increased safety was possible only by having a power plant which did not endanger the aircraft in case of its own failure, and then by using enough engines to ensure an acceptable probability of continued powered flight. After showing a frightening photograph of a wrecked B-47 pod, Mr. Schairer said that Boeing had frequently found that power plants had stopped dead in the air—sometimes for no obvious reason—so imparting a very great wrenching torque on the mountings. In the example shown, No. 2 engine had torn itself free and had wrecked No. 3 in the process.

A runaway fire had to be avoided at all costs, and the pod could most conveniently be sealed from the airframe and so prevent disastrous fires spreading into the wing.

Mr. Schairer's final points were the increased accessibility possible with podded engines, a reduction in internal noise level possible by their use, and the ease with which reverse thrust could be incorporated without damaging the airframe.

Discussion.—Opening, MR. G. R. EDWARDS (Vickers-Armstrongs) said, characteristically, "there is no controversy here; there are merely two ways of doing it and one is better." He believed that Mr. Schairer had put the cart before the horse, and that the B-47 development on the basis of the Breguet formula had led to a high aspect ratio which in turn increased the wing loading, the critical Mach number dictating the thickness/chord ratio, and leaving the designer with no alternative but to put the engine outside. He was convinced that a critical Mach number loss of about 0.03 must be experienced with the pod, and that the engine-cut case was another factor to be reckoned with. British designers felt firmly that, if there was room in the wing, it was best to put the engines there. Replying, Mr. Schairer pointed out that the B-47 had to do the B-29's work with the best turbojet available immediately after the war. Accordingly, a price had to be paid in take-off and landing qualities in order to obtain the range required; pods were put in solely as a result of the damage and safety aspects.

MR. S. D. DAVIES (A. V. Roe) pointed out that British aircraft did not normally cruise at

lift coefficients as high as 0.5, and that at values of the order of 0.2, the pod lost heavily. As far as safety was concerned, he favoured the aircraft with the lower wing loading, and would, in any case, not condition his designs to cater for a *major* failure. Regarding maintenance, Avros did not believe it was necessary to get all round an engine, and Mr. Davies said that, of those who kept the Vulcans serviceable all through the preceding week at Farnborough, the engine crews had had one of the easiest tasks.

The lecturer repeated that he could get a good critical Mach number with the nacelles on—sometimes better than with them off—and that the B-47 was designed to cruise at a lift coefficient of from 0.35 to 0.45. But he was greatly impressed by Mr. Davies' deltas.

MR. E. S. THOMPSON (G.E.C.) put the engine manufacturer's viewpoint, and said that his company offered to air-test the complete ducting work so as to give full information on the engine performance in a particular aircraft. Pods, he felt, could give performance corresponding to that obtained on the test-bed. The effect of ducting increased in importance with Mach number, and Mr. Thompson preferred the engine designer to do the complete nacelle design.

MR. W. A. CLEGERN (Convair) spoke of the B-47 nacelles added to the B-36, and of the B-52 nacelles which had been used to power the eight-jet YB-60 prototypes. With regard to the latter, the constant speed drive to the alternators had put small bumps under the pods but the installation was otherwise very clean, and had pleased Convair greatly. And to show how pod-minded Convair had become, Mr. Clegern gave the surprising news that their forthcoming supersonic bomber [the XB-58-Ed.] would have pods although it was a delta. On the other hand, its landing gear would retract into the wing.

MR. A. A. LOMBARD (Rolls-Royce) discussed the effect of pods on ruling out the possibility of a low wing, and also claimed that, because the nozzles were farther forward, passenger cabin noise was worse than with a buried engine, and noise-induced fatigue might be suffered by the wing under-surface. A thrust spoiler was essential for a transport, and the pod did not ease its installation. As for turbine wheel failures, surely this was a simple problem of stressing, with the complications of fatigue removed; failures just shouldn't happen, especially with the ferritic steels now standard.

MR. D. KEITH-LUCAS (Short and Harland) claimed that if pods had been so efficacious in cleaning up the kink in the B-47 pitching moment curve, something must have been very wrong with the static stability in the first case. Surely the pod had a bad effect on dynamic stability; everyone knew the flexure of a swept wing.

PROFESSOR J. D. AKERMAN (University of Minnesota) introduced some humour. No longer did Britain produce less graceful aircraft than America; the latest designs from his country would be flying porcupine deltas. But he was glad to see the variety of designs possible, and pointed out that in Russia one design only would be adopted—which it was depended upon whose plans they got hold of first.

MR. F. B. GREATREX (Rolls-Royce) was convinced that any range formula should include a fourth term, viz., engine efficiency. Contrary to the lecturer's experience, Rolls-Royce had found that fire-extinguishing gases could be extremely effective, as proved by considerable tunnel work.

MR. W. E. W. PETTER (Folland) felt that flexibility of operation was essential and that much lower lift coefficients were needed. Lower wing loadings were therefore indicated and high aspect ratio lost its importance. Other points raised by Mr. Petter were the adverse effect of pod surface area, the possible increase in vulnerability due to power plant spread, and the fact that future airflow requirements for boundary layer control might point towards the buried engine.

PROFESSOR A. D. BAXTER (College of Aeronautics) enquired why Boeings could not have been content with four engines. In reply, Mr. Schairer said that his company had to do a certain job with the most powerful engine available at the time, and the fact that six or eight were necessary was of minor consequence.

MR. G. H. LEE (Handley Page) contributed the following table, basing his calculations on equal span, Mach number and height and concentrating on parasite drag.

Percentages of Total Pod/Aircraft Drag

	Pods	Buried
Wing area... ...	5	1.55
Wing D100 ...	33	49
Fuselage	27	25
Nacelles	15	2
Remainder... ...	25	25
Total	100	101

Replying, the lecturer remembered another interesting point, namely, that Boeing had always found that a rigid engine mount broke in service more readily than a flexible one; the latter could absorb torque and acceleration loads more readily.

POWER PLANTS FOR ROTARY-WING AIRCRAFT

By CAPT. A. G. FORSYTH

(Chief helicopter engineer, Fairey Aviation Company, Ltd.)

AFTER arguing the case for the development of engines specially for helicopter installation —with a particularly longing look at a horizontally opposed 12-cyl layout—and suggesting a revision of the existing type-test conditions in order to increase the maximum possible continuous or one-hour rating, the lecturer turned his attention to gas turbines. These suffered principally in having a low starting torque and narrow power band, but Capt. Forsyth felt that much could be done with fluid drives or free turbines not mechanically coupled to the gas-producing part of the engine.

Tip drive was, however, the most reliable method, and this offered many significant advantages. Three 500 h.p. "engines" were examined: a ramjet of 6-700 lb thrust (tip velocity 650ft/min), a pulse jet for a 450ft/min tip speed, and a very compact pressure jet for a tip velocity of 650ft/min. The last named was the most promising. The first typical reaction-driven installation studied was based on a high-compression-ratio gas producer, like a turbojet, but with about 60 per cent of the total flow bled from an early compressor stage to re-enter the ducting behind the turbine. One duct led to a turbine/airscrew unit and the other duct to jet orifices about two-thirds radius along the rotor blades.

Many systems, some hypothetical and some actually under test were examined. The Fairey Gyrodyne, for example, now had two forward-facing airscrews driven by air turbines fed from a Leonides-powered compressor, all the output from which could be passed to pressure jets at the blade tips for landing or take off. Capt. Forsyth then dealt at some length with the types of arrangement possible in aircraft of the Rotodyne type, in which gas turbines drove auxiliary compressors feeding the rotor and airscrews, the latter being driven by free turbines. Alternatively, the airscrews could be driven from combustion chamber/turbine units, fed with compressed air from the fuselage gas turbines.

In the latter case, take off would be effected with the rotor absorbing all the air available, except for a small supply to the airscrews to maintain yawing control. The change-over to forward flight was made by closing down the rotor power and diverting the air to the outboard airscrews, each of the latter—in the example—being designed to absorb 1,000 h.p. Since the main engines had to develop 600 h.p. each in order to provide sufficient air to the outboard turbines to raise their power to 1,000 h.p. each (i.e., as the main units each developed 1,200 h.p.) it followed that forward flight was possible with one engine shut down. Maximum speed as a Gyrodyne merely implied full power on one airscrew, the supply of air from the other engine being passed to the blade-tip jets.

The lecturer went on to consider what could be done in the way of really large helicopters, and concluded that the jet-driven rotor offered the best solution. It enabled the powers required—up to 15,000 h.p. was visualized—to be developed without the great complication and weight of mechanical drives. But the application of free-turbine drive to the latter was worth studying, and the simplest form consisted of a piston engine driving a blower which supplied air to a free turbine mounted just below, and geared to, the rotor head. Round-about as this might appear, it offered many advantages over a rotor driven direct from the original engine.

In conclusion, Capt. Forsyth described and commented upon the various jet-rotored helicopters built and flown by the S.E. and S.O. groups in France, principally under the inspiration of M. Morain.

Discussion.—Opening the discussion, MR. R. H. MILLER (Kaman Aircraft Corporation) criticised the fuel consumption of the pressure jet, and said the whole arrangement was too complex and was only needed intermittently. In reply, Capt. Forsyth said that Fairey had proved, with a test rig mounting two Rolls-Royce Darts driving a 60ft rotor, that the pressure jet could be made to work well. As an example of the reduced complexity possible, the rotor did not need to have drag hinges.

MR. W. TYE (Air Registration Board) announced that his organization was in the process of drawing up a new engine test schedule to offer more useful helicopter ratings. It was advantageous if a power/time graph were drawn of typical helicopter operations, to which the test schedule should have a definite relationship. There was, of course, a direct relationship between the amount of high-power running carried out and the permissible overhaul life. The lecturer replied that a continuous rating of 92 per cent full power appeared the best solution.

MR. D. L. HOLLIS-WILLIAMS (Westland) urged caution in the adoption of tip drive. One had to be sure that the 8-10 per cent power absorbed by an anti-torque tail rotor really was saved; perhaps the mechanical hub drive would last longer than was often imagined.

MR. RAOUL HAFNER (Bristol) also urged the adoption of the highest possible continuous rating; in his opinion, all-out take-off power was unnecessary. He recalled that Bristols had, some years ago, developed a promising sleeve-valve flat-twelve engine for the Type 171 helicopter but, in his view the piston engine was outdated. On the other hand, he was by no means convinced of the inevitability of tip drive. Even if 100ft was the limiting diameter for a hub-driven rotor, this was quite big, by any standard. With the modern trend towards increased loadings, such a rotor could support a very large aircraft with a 10 lb/sq ft disc loading. There were, at present, 12 gears in the main drives of the Bristol 173; when a later Bristol helicopter adopted turbine power units, 22 gears would be needed. As for the tip-drive rotor, Mr. Hafner was apprehensive of the troubles to be met with so hot a structure, particularly since it was subject to fatigue. He preferred "the devil he knew"—the shaft drive.

Capt. Forsyth, replying, pointed out that Faireys wanted a very fast aircraft, for which the single rotor was mandatory. The gas-shaft, or tip-drive offered fewer transmission losses and, in spite of the possible complexities and the differential expansion factor, he believed that the best solution was that which he had propounded, namely, a rotor passing a fairly hot airflow to pressure jets at the tips.

MR. M. G. BEARD (American Airlines) underlined the interest now being shown in the helicopter by American scheduled operators. He feared that legislation would forbid the entry of helicopters into towns if nothing were done to maintain noise at its present level or, ideally, to reduce it. Twin-engined safety was considered essential. He was not yet convinced of the utility of Capt. Forsyth's arrangements, and asked about the bulk occupied by the engines and ducting, and whether there might be any fire risk attached to the use of hot bleed or combustion air. He remember that, in a study of an 85-passenger fixed-wing aircraft, the assumed cost of the turboprop had doubled during the period of the examination, wiping out that engine's former advantage over the turbojet.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Farnborough

ONCE again we have enjoyed the spectacle of the world's finest pilots performing in the world's greatest air display. It is, however, unfortunate that the authorities decided to be over-cautious regarding the safety of the public. We can appreciate their anxiety after the 1952 tragedy, but we do not wish the spirits of the pilots to be subdued. Farnborough, after all, is their day as much as it is ours. We are surely willing to take certain risks; risks which test-pilots take almost every day of their lives. If we did not feel that way, we would not be at the Display. Let not the well-remembered thrills of watching the late John Derry steep-turning the circuit at nought feet be forgotten in a cloud of carefulness. We, the humble spectators, wish to see again the perfection of high-precision flying.

Eastleigh, Hants. T. C. HUTTON.

The S.E.5

WITH reference to Mr. J. M. Bruce's letter (September 11th) querying the serial number of McCudden's special S.E.5A, in his book *Five Years in the Royal Flying Corps* McCudden says: "On the 3rd December (1917) a new factory-built S.E.5 came to my flight and I at once took it over. My new S.E. was numbered A/4891 and was fitted with elevators with a narrow chord, which was an improvement, and also had a new type of undercarriage which was much stronger than the other."

In January 1918 he had high-compression pistons fitted to the Hispano engine, first flying it on the 28th, and remarks on the improvement in climb: "I was up to 10,000 ft in little more in minutes than there are days in the week."

Penzance. E. C. D. MALONE.

Coloured Picture

HAVING just finished reading an article on B-47 practice-bombing missions in the September issue of *Reader's Digest*, I can begin to understand any doubts the American public may have about the operational safety of large jet aircraft.

When I read of take-off speeds of 145 knots, of the last seconds of a jet take-off requiring "exquisite judgment" to avoid either stalling or overshooting the runway, and of the aircraft "leaving the ground with reluctance," well—if I didn't know any better, I would turn grey at even the thought of passenger-carrying jets!

And yet, according to the author, getting airborne is only the start of things. There is, it seems, something called "coffin corner" about B-47 flights, where for an hour or so the aircraft is apparently flying on a borderline of 10 knots or so between stalling and "sound-barrier buffeting." And then, finally, the landing has to be on the first few feet of the runway, otherwise—*finis* yet again.

Whether or not this might be so in the case of the B-47, anybody reading this article, and completely ignorant of Comet and Canberra operating conditions, might be excused if he thought this sort of thing was common to all large jets. It makes amusing reading when compared with your own Canberra flying article of a few weeks ago. It made me wonder what the poor B-47 crews are going to do if the day ever comes when, in addition to all this, they have an enemy to fight!

Glasgow, W.2. H. C. CLIFFORD.

[The B-47 is certainly no aircraft for the novice pilot; but many hundreds are now operating in global service, and without a high accident rate.—Ed.]

Jet Training ab Initio

IN your editorial of August 14th, wherein the question of all-through jet training is discussed, it is suggested that the R.A.F. may decide that the effects of controls and first experience of flying may be better given on an elementary piston-engined aircraft. It is not clear what gain is expected to accrue from this unless it is assumed that an aircraft such as the Jet Provost will prove more formidable than the same aircraft powered with a piston-engine.

It is not difficult to make an intelligent guess as to the probable performance of a Viper-powered Provost which will actually have some 300 lb *less* static thrust than its Leonides-powered counterpart. There can be little difference in stalling and approach speeds and, since it has been announced that wings and empennage are basically similar it may be assumed that the handling qualities will also be basically similar except, of course, where they are affected by slipstream. If, therefore, the R.A.F. are satisfied that *ab initio* training can be carried out in the piston-engined Provost, why the suggestion that, with the introduction of a jet-powered variant, an elementary piston-engined aircraft will be required for the first thirty hours' flying experience?

It seems to me that the piston-engined trainer, especially one with a tailwheel undercarriage, is completely outmoded and that it will merely clutter up the training organization with an unwanted additional type.

In one place the editorial suggests that this piston-engined training can be followed by "a jet trainer of lively performance which can take over at about 30 hours and serve right through to . . . wings standard." Presumably the Vampire T.11 is referred to. Later in the article it is suggested that "with the advent of a jet basic trainer it would be desirable to carry the pilot farther than at present before conversion to Vampires." Presumably this refers to a trainer of the Jet Provost type. It would seem obvious that the latter is infinitely preferable on all counts.

Once it is shown (and it is difficult to suppose that it will not be shown) that the first 20 or so hours of a pupil's career can satisfactorily be flown on the Jet Provost the case is proved for all-through jet training, since it is apparent that the more jet flying the pupil receives the better jet pilot will he become. From now and henceforth the crying need must be the maximum hours on jets and no learning, at any stage, the so-different piston-engined techniques. I would go so far as to say that the standard will be so far improved as to make possible a quite considerable reduction in the total hours to wings standard, thus effecting a most desirable overall economy.

It is only to be hoped that piston-engined vested interests and Air Staff conservatism will not be allowed to hinder this most hopeful and overdue training development.

London, W.C.2. A. C. BIGGAR.

[We agree with much of what our correspondent says; at the same time, we approve what we believe is the official view—in short, that the case for all-jet training from the elementary stage should be proved before the whole of the flying Services are committed to it. As to reduction in training-time, we think—and have said in the past—it would be bad policy to reduce the present flying hours or length of course bringing the pupil to wings standard, for economy or any other reasons.—Ed.]

Thanks, Annie

IN your journal *Flight* of the 21st August I found a mistake on page 218, "Believe it or Not." That aircraft, a B-17G, has really been taken out of the Lake Zugersee. But, please, Karlsruhe is in Germany, quite far away. It is not very nice of you to confuse a part of the Tausendjahrige Reich with my little country. Zukersee is between Zurich and Lucerne, in fact more close to Lucerne.

I will tell you right now they are trying to lift up, and out, one more aircraft, at Greifensee, close to Zurich. I hope they will be successful. Now I will only tell you that your country is a beautiful place and that I like it very much. I shall soon be there for the Farnborough Air Show, and we will have a *tour d'Angleterre*. [This was written before the Show—Ed.]

Can you ever forgive me my terrible writing, with mistakes, more as a first-class girl?

St. Moritz-Bad, Switzerland. ANNIE LIEBERMANN.

Corrector Corrected

I NOTICE that the firm of J. H. Keller AG, in writing (September 11th issue) to correct certain small points in your article "Entomological War in Switzerland" are guilty of a far less excusable error themselves, since presumably they are Swiss: Both Bex-les-Bains and Aigle are in the canton of Vaud, not Valais as they state.

Sidford, Devon. PETER TATE.

FORTHCOMING EVENTS

Sept.	26.	R.A.F.A. Stansted Branch: Air Display, Stansted Airfield.
Sept.	27.	Aero-Club d'Italia: Modena Air Rally.
Oct.	3.	Helicopter Association: "Problems of Helicopter Operation Peculiar to Shipboard Use," by Lt.-Cdr. H. R. Spedding, R.N.; "Helicopters and the Whaling Industry," by A. E. Bristow.
Oct.	5-9.	I.A.T.A. Annual General Meeting, Montreal.
Oct.	8.	Start of England-Christchurch (N.Z.) Air Race.
Oct.	9.	Airlines Ball, Royal Albert Hall, London.
Oct.	23.	Aerauto Association: Annual Dinner and Dance.
Oct.	28-30.	Institute of Welding: Annual Dinner and London Autumn Meeting.
Nov.	6.	Helicopter Association: Discussion: "The Independent Airline Operator and the Helicopter."
Nov.	6-11.	"Dates" Air Rally, Biskra, Algeria.
Dec.	4.	Helicopter Association: "Ground Resonance," by R. Howarth.
Dec.	9.	Royal United Service Institution: "Effects on the Human Body of High-speed and High-altitude Flight," by G/C. W. K. Stewart, C.B.E., A.F.C., B.Sc., M.B., Ch.B.
Dec.	17.	Anniversary of the Wright Brothers' First Flight.

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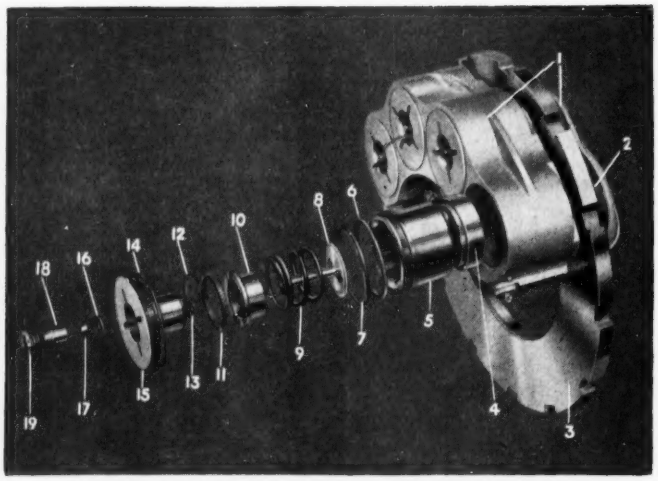

Exploded view of the Goodyear Disc brake, showing arrangement of the automatic adjustment components.

1. *Brake Housing* **2.** *Inboard Lining* **3.** *Disc* **4.** *Outboard Lining* **5.** *Piston* **6.** *Leather Wiper Ring* **7.** *Piston Seal* **8.** *Self-Adjusting Pin* **9.** *Brake Release Spring* **10.** *Spring Seat* **11.** *Spring Retaining and Adjusting Ring* **12.** *Retaining Ring* **13.** *Adjusting Pin Seal* **14.** *Cylinder Head Seal* **15.** *Cylinder Head* **16.** *Washer* **17.** *Adjusting Pin Grip* **18.** *Spacer* **19.** *Adjusting Pin Nut*

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NEW DEVELOPMENTS

—*in Components and Materials: Further Notes on the Static Show at Farnborough*

IN our Farnborough Report Number (September 11th) we devoted space to a "first inspection" of the products in the exhibition hall, and last week we amplified and added to the information there given. It is now possible, in the following notes, to review a considerable number of other new developments in components, accessories and materials, and in some instances to enlarge further on items already briefly mentioned. For the sake of brevity, firms are indicated by short titles only.

The main theme of the **Acton Bolt** stand was the "life-story" of one of their bolts from the initial material inspection to the final delivery, the emphasis everywhere being on close tolerance. The specimen used was an A.30 bolt, cold-headed, this being of the degree of tolerance now frequently demanded in airborne applications.

Perhaps the biggest exhibit in the indoor exhibition was the new AT.100 twin-engine, dual-control instrument-flying trainer developed by **Air Trainers, Ltd.** This has been prepared to meet the basic airline need of a simulator capable of teaching airways procedures and instrument flying, while not simulating any specified type of transport. Actually, the AT.100 most nearly reproduces the characteristics of a Convair-Liner, and the cockpit is one in which any piston-engine pilot would at once feel at home. The equipment is usefully flexible and can faithfully simulate engine-cuts on take-off, navigational problems, icing or mechanical failures, rough-air effects, D.M.E. procedure and blind landing.

Once again, the **Airscrew Company and Jicwood** showed how wide a range of air-blowing fans and airscrews they make. Prominent was the stub of one of seven blades made for the Vickers-Armstrongs 24ft tunnel. Much smaller was the windmill driving the winch of the Mosquito T.T.39 target tug. Similar to the latter in size only was the 2ft diameter fixed-pitch wooden airscrew for the pilotless target No. 2 M.1; the company also make the 4ft 6in unit driving the M.L. target U-120D, but this was not shown. In a different sphere was the Viscount windscreen demisting fan, delivering 30 cu ft/min against 3.8in standard water gauge, this being a Jicwood centrifugal blower turning at 8,000 r.p.m. Of greater capacity was the "bird-cage"-type radial-flow fan used somewhere in the Victor and, turning at 6,080 r.p.m., capable of delivering no less than 1,250 cu ft/min against 12in water gauge.

It is instructive to examine the extent to which steels, aluminium, magnesium and other alloys are used in gas turbines. The **Birmal** stand, for example, was occupied by major components for two of our most important engines, one of which uses magnesium and the other aluminium. The Olympus compressor casing is made in steel over the high-pressure (rear) rotor and in ZRE1 magnesium-zirconium alloy over the low-pressure section. Birmal sand-cast the low-pressure case, and the half unit displayed weighed 114 lb. The company also produce the main Olympus intake, in similar material, weighing 168 lb. Of higher specific gravity but of reduced wall thickness was the half casing for the Avon compressor; in EXP.99 aluminium alloy, this unit weighed 149 lb. The Avon casing was a particularly fine piece of casting, complete with basic stator-blade-holding grooves, and it was shown as-cast, after blasting to remove roughness.

Continuing their development of all types of sprayed-on plastic coatings and sealing envelopes, **R. A. Brand** displayed a series of specimen Cellon-coated sheets over which had been sprayed a layer of protective Koonkote. Plastic Type 19 is another protective sheet, sprayed on to a surface to obviate scratching, rusting, or the deposition of such things as paint drops or corrosive fluid; it was shown applied to high-gloss aluminium. A model Ghost was on view neatly wrapped in Texicoon— a sprayed-on envelope which can be unzipped and used again—in which form these engines are stored in all climates along B.O.A.C.'s Comet routes. A full-size radio sub-assembly pack was also on view, together with the re-sealing kit used to complete the preparation of the envelope in the field. From the rear wall of Brand's stand loomed the bows of a model Saro Princess, to remind visitors of the company's biggest packages to date.

Three singularly interesting fighter drop-tanks were exhibited by **British Emulsifiers** as examples of their fabricated products. These were: a 150-gallon light alloy tank for the Vampire, more streamlined than the cigar type usually seen; a 90-gallon light alloy unit in Naval duck-egg green for the Wyvern; and a 93-gallon steel tank for Pakistan Attackers, this having a built-up flat central portion and rounded side panels, the whole looking rather like a Sabre slipper tank. None of these tanks carried fins, for none was for a wing-tip mounting.

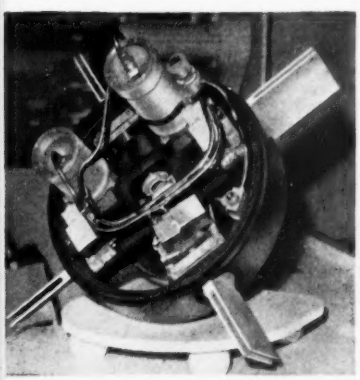
Exhibiting for the first time was the firm of **British Manufacture and Research,** a company of the Hispano Suiza group. They are clearly more concerned with armament than with aero engines, and their stand featured models of various ground-to-air mountings, for armies and navies, involving two or four guns of 20 or 30mm calibre. These designs are, we were told, in course of production. The only full-size exhibit was a breech and "machinery end" of a standard Hispano 20mm Mk 5 gun, with flat feed. No information was forthcoming concerning the progress of the company's airborne 30mm weapons. The factory at Grantham, incidentally, was opened in 1939, and was virtually taken over by the Government in the war for the production of aircraft cannon.

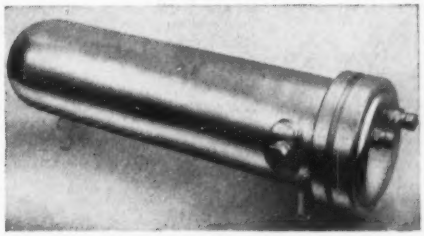
A first peep inside any form of British missile was afforded visitors to the stand of **British Messier,** whose very new landing-gear units were commented upon in our previous issue. The company had clearance to show the unit illustrated on this page, beside which was the legend "Hydraulic Servo Unit for Guided Missiles; the system consists of a source of stored hydraulic power for electrically operated control valves connected to actuators or jacks which operate the central fin shafts of the missile. The electrically operated valves receive small power signals from an electronic control and guidance amplifier." The circular periphery was a very heavy machined ring which formed the actual body of the missile at this point; the edges of the ring were rebated so that the adjacent missile sections could be lap-jointed with a smooth exterior, free from any ridge, the joint presumably being made by quick-release bolts. Inside the ring was a massive "spider" housing four roller bearings in which were pivoted the four guidance-fin shafts spaced at 90 deg to each other around the missile. The roots attachments for the vanes appeared to be machined forgings in light alloy, with flat fork ends in which the vanes could be located. The two hydraulic cylinders, visible in the photograph, presumably were accumulators feeding the vane-operating jacks under the control of the electric valves so as to move the vanes together or in opposition. Rigid metal pipe was used, probably to meet acceleration-loading requirements. A rocket-propelled vehicle does not, of course, normally carry a hydraulic pump.

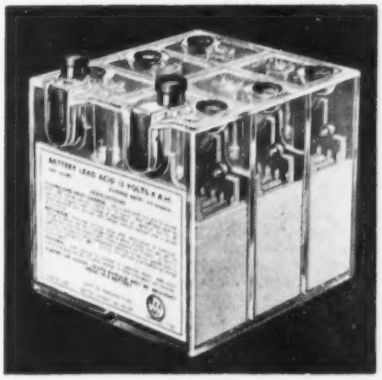
Among the range of gas-turbine components shown by **Brown Bayley Steels** were two major items for the de Havilland Ghost: the rear casing around the combustion chamber, which is in D.T.D.493, and the central hub shaft and extension shaft between the turbine and the compressor, this being a high-quality forging in S-11 nickel-chrome steel. A flame-tube for the Proteus turboprop was another item; B.A.C.E. 183 stainless steel is the material here concerned.

Typical of the many types of calibration and test stands developed by **Bryans Aeroquipment** was a large rig prepared, in conjunction with Normalair, for testing the latter company's demand oxygen regulators. The regulator under examination is mounted centrally in the stand, facing the operator, within the vacuum chamber, which is leakproof up to an equivalent altitude of 100,000ft (i.e., the chamber can virtually withstand a complete vacuum). Also on the central panel are three flowmeters covering the full range of airflow into the demand oxygen regulator from the vacuum chamber; another panel to the left carries the flowmeters for measuring the low-pressure oxygen-flow through the regulator in one test, and a similar panel on the right mounts three flowmeters for determining the flow of air/oxygen mixture out of the regulator.

The principal development from **Chloride Batteries** (the makers of Exide batteries, formerly the Chloride Electrical Storage Co.), was an unusually compact accumulator for miscellaneous aircraft duties. Designated 6-MNA17, the new unit has a capacity of 4 amp-hr at 12 V, yet weighs but 4¼ lb complete with acid. The six cell groups are composed of specially designed plates separated by sheets of Porvic (a microporous plastic) and glass wool, and housed in a container and cover each moulded in one piece in polystyrene. The fact that most of the electrolyte is absorbed by the separators, while the surplus is trapped beneath the vent in each cell, renders the battery virtually unspillable; another good feature is the low open-circuit loss, which permits long storage in a charged condition. The 6-MNA17 is at present used in modern







The British Messier stand featured a guided-missile control fin assembly (left); Delaney Gallay exhibited a new fuel-cooled oil cooler (below) and Chloride Batteries showed their new lightweight 4 amp-hr cell.

NEW DEVELOPMENTS . . .

military aircraft to power canopy-jettison gear, v.h.f. equipment, and other devices. It is illustrated on page 445.

Two quite new developments are exhibited by **Delaney Gallay.** The first, illustrated in this review, was a lightweight oil-cooler for turbojets. Although made entirely of light alloy, the unit has a very high heat transfer performance and is clearly intended for aircraft of the most advanced type. The unit operates on the cross-counterflow principle, the high-pressure side being kerosine fuel at 1,000lb/sq in, or more, and the low-pressure (cooled) flow being oil of one of the recent synthetic varieties. Use of high fuel flows permits fewer passes to be made, and the evident U-tube construction eliminates differential expansion. The header can be adapted to suit a variety of specific applications; the dimensions of the cooler, as shown, are 6in diameter by 21in overall. The other Delaney Gallay development is the production of heat-insulating blankets capable of standing up to the very high temperatures experienced in the immediate neighbourhood of large turbojets with reheat. For this work, asbestos or glass fibres break down (say Gallay) and the new insulator is a rock-based fibre known as Thermoflex, in the production of which they are co-operating with the Johns-Manville company of New York. Gallay produce the material as a flat sheet, looking like a carpet underfelt some half-inch thick. Blankets are cut to patterns and tailormade for each application; one thickness can, it is claimed, reduce absolute temperature by 55 per cent. The complete lagging—which is extremely light, at about 1/10 lb/sq ft—is sealed between stabilizing and heat-reflecting sheets of stainless steel foil.

Now known by the name of **Dragonair,** D. A. Daniel continue to develop heating equipment of the same indirect type, in which a high-efficiency heat-exchanger is used to pass heat from the exhaust gases from a burning fuel/air mixture to a rapidly moving stream of fresh air, the latter then being passed to its destination free from contamination with the products of combustion from the burner. The range of air-borne units, for de-icing and cabin-heating, continues to develop, but the largest unit shown this year was a ground unit, of five therms capacity. This unit embodies an oil-fired air heater, supplied with its own fan, motor and fuel pump, the whole being under electric control. The equipment is very quiet in operation and, of course, the heater can be shut down in summer and cold fresh air supplied to the building or aircraft being served.

What appears to be one of the elusive "something for nothing" developments is **Electro-Hydraulics'** Monomatic hydraulic system, of which a demonstration rig was on view. Briefly, the pumps, selectors and release valves for a given service are all mounted adjacent to the circuit giving the highest power—in the example given, the landing-gear-raising circuit—so making for a self-contained system with short pipes, and consequent low weight and transmission losses. For example, the nose undercarriage jack is connected to the port or starboard main lines and, for emergency lowering of either port or nose legs, those circuits are connected to the main starboard system through a shuttle valve. Total saving of pipe weight may be as much as 30 per cent, and the normal pumps can be used in emergencies; further, the system components can be grouped as a unit easily removable for maintenance.

Used for some time in the general commercial field, and with obvious aeronautical possibilities (as we said in our B.I.F. review last May), a specimen of sandwich construction by **Essex Aero** was displayed on that company's stand. Formed from two metal sheets spaced apart by truncated metal cones spread uniformly over the surface, the largest panel so far produced—made for a "star" suspended over Northumberland Avenue during the Festival of Britain—was a roughly triangular magnesium assembly 16ft 6in by 4ft base width. Bakelite thermosetting adhesive was used on the S.B.A.C. exhibit, but work is now centred on soldered cones, the low-temperature solder having better adhesive strength and not affecting the heat treatment of the cones and sheets. Turning to fuel tanks, one of the largest ever made by Essex Aero is the overload tank for the Beverley. This is formed from large sheets of 118A magnesium alloy, seam welded, and protected by a covering of black rubber. After manufacture the tank is tested to 1½ lb/sq in continuous, or 5 lb/sq in for a short period, and the capacity and equipped weight are, respectively, 845 gallons and 196 lb. The tank is carried inside the Beverley strapped to a cradle which is then lashed to the floor to prevent movement; the tank is also cleared for parachute dropping, presumably when filled.

Rather delicate aircraft components have, until recently, been rigidly packed for shipment within wooden crates, in which they have been located by shaped mounting brackets. **Export Packing Service** have found that the distortion sometimes experienced by the crate—as, for example, after a fall on to one corner—is thereby transmitted to the component. To obviate this, E.P.S. have developed an axial or three-point suspension packing in which the item is free from the possibility of being distorted by movement of the case. At Farnborough, a pair of Firefly fins were packed according to the two methods, a neat strain-gauge rig showing the difference in transmitted strain experienced by the fins when the crates were equally deflected.

Living up to their name, **Fireproof Tanks** continue to develop a comprehensive series of protective tank coatings, including those for metal and flexible tanks. Beechvalley glass-fabric coverings were shown applied to various types of tank, and a complete flexible, bright green Hycatrol tank was shown, with its protruding bolts shielded for sealing into the polythene envelope. The basic tank, which had a capacity of 62 gallons, weighed 11¼ lb.

One of the few new **General Electric** developments that can be freely discussed is a low-intensity runway and taxiway light, known as Type ZA 204. Of the lightest weight possible, the new light employs no glass in its construction (unless a colour filter is specified), the optical system consisting of an accurately machined cylindrical prismatic reflector of Perspex, with internal prisms, located in a spun aluminium gallery. The 36-watt pre-focused lamp is housed within the cylinder beneath a spun cap held in place by a rustless spring, the joint being weatherproof without the use of gaskets. The entire assembly, with mounting base, weighs but 1 lb. A completely different development, but one about which nothing can be said, is the control and guidance system that G.E.C. have produced for the Armstrong Whitworth guided-missile test-vehicle. Even this is but a fraction of the company's work in the guided-weapon sphere.

A Bunsen burner rig was used by the Ministry of Supply to demonstrate the continuous resetting fire-detecting wire, developed by the R.A.E., now in production by **Graviner**—under the name of Firewire—and also shown on Graviner's stand. This, claimed to be the greatest advance in fire-detecting work in twenty years, uses a detecting element consisting of a co-axial cable, the inner nichrome wire being placed absolutely concentrically within an outer stainless-steel sheath, from which it is separated by a filling of active material. This active substance exhibits a remarkable electrical resistance/temperature curve in that, at a temperature which can be chosen by varying the composition (but constant for a given material), the resistance falls very rapidly. At normal temperatures the resistance of the Firewire is some 2 megohms on open circuit, but local heating beyond the critical temperature closes the circuit and operates all the connected horns, bottles or other devices. After the fire has been extinguished the element returns to its original condition without attention, ready for the next emergency. The circuit can readily be ground tested, and Graviner are already producing the element in 10ft lengths with connecting couplings. Altogether, this appears an outstanding contribution to aircraft safety.

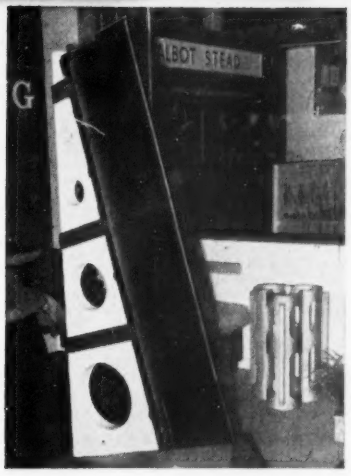
High Duty Alloys, although a member company of the Hawker Siddeley Group, continue to have their own stand, and they showed several important components which they make in their range of specialist alloys. The main leg for the Britannia bogie undercarriage, for example, is forged in Hiduminium RR.77. The heart of the Sapphire turbojet, the outlet branch casing, is a large forging in Hiduminium RR.58, afterwards machined to its final configuration (this component, we believe, is a built-up welded assembly in nodular iron sheet in the Curtiss-Wright J65 version of this engine). As an example of H.D.A. magnesium-alloy work, the main air duct and gearbox casing for the Double Mamba was shown: this is a sand casting in Magnuminium 220, afterwards chromated to the familiar black finish common to such alloys.

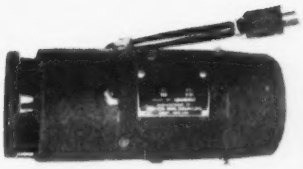
A particularly commendable unit by **Hymatic** was the pneumatic ram, Type RES1. This neat actuator has been developed to provide a powerful jack for the emergency jettisoning of cockpit canopies, and similar applications, in which sure and rapid actuation is required without the added complexity and weight of installing a conventional pneumatic system. Air at a pressure of 3,000 lb/sq in is stored within the jack itself; when the pilot selects "canopy jettison" a cable or rod control lever releases the piston, which at once provides a load of 4,000 lb, falling to 1,000 lb at the end of the stroke. The RES1 weighs only 2½ lb.

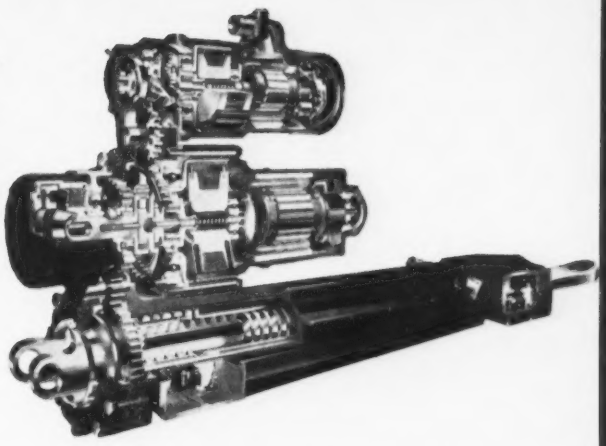
Flying safety should be improved by the steady adoption of ferritic steels for gas turbines, for the austenitic materials formerly used have proved less reliable, and do not lend themselves well to the laying down of specifications. The **Jessop** stand was this year more "ferritic" than ever, and many new alloys have made their contribution to the products of other companies. The Rotax cartridge starter, for example, uses a one-piece turbine complete with blades, machined from an H.46 forging. This new alloy has a scaling resistance suitable for work at 650 deg C, together with better creep strength than the well-known H.40. Precision casting is meeting the needs of mass-production gas turbines, and many of the millions of nozzle guide vanes needed are being made in Jessop G.34—a cobalt-base alloy, which precision casts well and exhibits good properties up to 900/950 deg C—or G.39, the latest alloy for such work, containing 60 per cent nickel and capable of use at temperatures over 1,000 deg C; this alloy also can be precision cast and has useful resistance to thermal shock. New turbine blade materials are G.32—cobalt-based like G.34 but used wrought—and G.42, designed for very hot turbines at 850/950 deg C, the composition being: Fe, 41; Co, 25; Cr, 19; and Ni, 15 per cent.

Illustrated last week, the new precision engine speed indicator developed by **Kelvin and Hughes** fills a long-existing need in turbojet-powered aircraft—in which, in the interests of fuel economy, the engine speed should be known within ± 0.2 per cent. The basic electro-mechanical oscillator can be set against a dial and then maintained at any frequency within a standard range, against which the frequency output from a standard tachometer generator may be compared. The difference between the frequencies drives a small synchroscope, the black-and-white dial of which turns clockwise for "too fast" and *vice versa.* Other new K. and H. instruments are a transonic Machmeter, reading from M = 0.7 to 1.3 at all altitudes up to 60,000ft (and fitted in production Hunters), and a sensitive altimeter with counting barometric scale. The design of the latter enables the altimeter to be correlated to the barometric scale to within five feet accuracy, and virtually eliminates backlash. A new pointer arrangement makes for immediate interpretation at all altitudes up to 60,000ft, and the new form of presentation is being adopted as standard for military aircraft.

Main exhibits on the stand of **Kent Alloys** were examples of advanced castings in magnesium alloys, and there is no doubt that a great contribution has been made in the development of Z5Z, ZRE1 and RZ5, all of which benefit from the fine grain structure made possible by the introduction of zirconium. Z5Z has the highest proof-stress, ZRE1 is completely pressure-tight and can be used up to 250 deg C, while RZ5 has even less porosity than ZRE1 and can also be Argonarc welded. The Kent stand was dominated by the black (chromated) magnesium-alloy sand casting illustrated on the next page. We were told it was a wing, and certainly the lower edge appeared to form a sharp leading edge, the aspect ratio then being about one-quarter! It comprised three sections pinned together and welded, the overall dimensions being about 6ft chord by 1½ft semi-span. Perhaps this exhibit had something to do with the very fine aluminium-alloy casting on the floor beside it,







On Kent Alloys' stand (left) were a magnesium wing and an aluminium casting, both referred to on p. 446. Above is a recent Newton rotary transformer, while the 30,000 lb. Rotax actuator (right) drives the main landing gear of a heavy new aircraft.

NEW DEVELOPMENTS . . .

which appeared to house three rocket motors (see photograph above).

To show the sort of packing required by an instrument of the nature of a Normalair N.P. pressure controller, **Lep Transport** exhibited such a unit packed by them for shipment by any means of transport in any climate. Initially located by sponge rubber and wax paper, the unit was housed in a floating inner cabinet containing a silica-gel dessicant pad and covered by a heat- and water-proof metal foil wrapping, with cloth backing. The inner case was in turn located by rubber blocks within an outer wood case, lined with waterproof paper and fitted with Sheradized screws, cement-coated nails and lifting irons.

Although we briefly described it on September 4th, the reheat fuel pump developed by **Joseph Lucas (G.T.E.)** is of such interest that further details should now be given. The whole unit is commendably compact, and it is fed with hot air taken from the delivery end (P_2) of the main engine compressor. This bleed air drives a simple impulse turbine at some 24,000 r.p.m. which is directly coupled to a single radial-flow impeller which can deliver no less than 2,000 gal/hr at pressures in excess of 600 lb/sq in. The unit is suitable for use with any fuel, and it is remarkable that such a delivery at so high a pressure can be maintained with one small centrifugal stage, particularly as the tolerances involved are no handicap to mass production. The pump is governed by two solenoids, one controlling the fuel flow and the other the supply of compressor-bleed air.

The well-known flexible-tank firm of **Marston Excelsior** showed an unusual amount of plastic work this year. Low-pressure ducting and aerial housings were exhibited in glasscloth bonded with Nuron resin, and a colourful series of dome-shapes revealed themselves as the dielectric nosecaps of the Hunter, Swift and an unspecified all-weather fighter, beneath which lie the gunsight or search radar-aerial. The caps were all made in a sandwich composed of two hard, smooth glasscloth layers separated by a very light stabilizing core, of a substance like Onazote or expanded Hycar. The Hunter cap was increased in thickness over the greater part of its area, there being three glass layers and two filler layers. The camera of the Hunter is mounted to "see" through the upper nose skin, but that of the Swift is slightly nearer the nose and so requires a large groove to be moulded in the nosecap, at "2 o'clock" as seen from the front. Recent examples of Flexelite tankage were also displayed by Marston Excelsior, all featuring the familiar rubber/nylon wall with a specific weight of but 2½ or 5 oz/sq ft. For the Comet, Marston supply four central bag tanks with a combined capacity exceeding 2,000 gallons, the total weight being no more than 116 lb. Marex heat exchangers continue to appear for all the latest airliner designs, for de-icing, cabin air conditioning and other purposes. Of brazed light alloy, they are claimed to be some 30-50 per cent lighter than equivalent copper units.

Among the many electrical machines developed by **Newton Brothers (Derby)** was a rotary transformer of the same weight and size as a well-known unit now in use but, by means of a special cooling fan, with an output raised from 45 to 100 watts. Illustrated on this page is rotary transformer Type 1592, with an input of 27 V, 8.5 amp, and an output of 350 V, 0.37 amp. A.C./D.C. voltage regulators were also exhibited, among them being a new pattern with flat springs, which are easier to assemble and adjust than the spiral or helical pattern more commonly used; further, the new spring assembly incorporates the temperature-compensating bi-metallic strip.

Hardly appropriate for treatment in the radio article in our last issue, the five-stage dekatron counter developed by Labgear (of the **Pye** group) fills a gap in our computing and counting machinery. This singularly compact and efficient equipment uses five dekatron glow transfer tubes, with hard valve inter-stage triggering circuits. A selector switch allows the instrument to operate either on a sine wave or a pulse drive basis. Essentially flexible to meet all normal needs in industrial counting, the unit consumes 36 watts of domestic current, and weighs but 18½ lb.

Automatic fire detection in aircraft power plant bays is claimed for the **Pyrene** continuous-resetting fire detector, Type P.F.D.1. It consists of an operating head connected to 25ft of sensitive element wound round each engine. The element will withstand ambient temperatures ranging from −65 to +275 deg C, with changes at rates of around 100 deg C per minute, without giving a false alarm. But any portion of the detecting tube heated by flame automatically gives warning of a fire, the signal being mechanically registered by the closure of a pair of electric contacts. Supplementing this detector is a new high-rate discharge system, capable of issuing methyl bromide at no less than 12 lb/sec; this is distributed throughout the entire neighbourhood of the power plant through specially designed nozzles.

Illustrated on this page, in sectioned form, is a heavy-duty electric actuator developed by **Rotax** to actuate the main landing gear of an unspecified British aircraft. Although the operating load of this unit is 30,000 lb, it is by no means the largest of its family, and Rotax also make smaller units down to 20 lb load. The heavy supply current (at 112 v) is necessarily passed through contactors and, if the circuit breakers take the main motor out of circuit, the smaller stand-by motor —mounted on top—can complete the operation although, since it has to drive through an extra gear stage, it takes four times as long. The great operating load demands a recirculating ball thread to reduce friction and, in all such arrangements, Rotax can claim an efficiency exceeding 90 per cent. As regards weight, this unit scaled 100 lb but, because the jack acts as a strut with a very considerable static load capability, the actuator replaces what would otherwise be a weighty part of the undercarriage linkage. Although the main work of Rotax continues to be the development of all types of electrical machinery, the company's starter motors continue to be of ever-increasing interest. It is not generally known that Bendix (U.S.A.) prepared to build the Rotax cartridge starter, but found difficulty in obtaining the necessary supplies of cordite. Accordingly the American company redesigned the Rotax unit to burn a petrol/air mixture and—the wheel having turned full circle—Rotax now licence-produce the Bendix starter, an example being shown by Rotax at Farnborough. As far as liquid-fuel units are concerned, Rotax are by no means convinced that a monofuel arrangement (e.g. iso-propyl nitrate) is the best, and work is continuing with the development of starters burning petrol, kerosine, wide-cut gasoline and cordite. In the case of the starters using aircraft fuel, it should be noted that the combustion chamber of the starter burns a stoichiometric (i.e. chemically correct) mixture, which gives a very much hotter flame than the sixty-times-diluted mixture of a turbojet. But the advantages claimed by Rotax for the arrangement are: that fuel from the main tankage can be used, so that the complete installed starter system weighs less than a monofuel unit; the fuel system is clearly less complex; and the whole starter can be mounted under the nose bullet of a fighter engine, the exhaust being passed straight into the main engine intake. Iso-propyl nitrate exhaust is, it must be admitted, rather corrosive, and requires a separate pipe system to pass it overboard in a safe place.

An associated company of G.E.C., **Salford Electrical Instruments** displayed much equipment, the biggest item being Type B.W.647 mobile power rectifier, for serving aircraft with ground D.C. current at 28 v. It has been adopted by the U.S.A.F. in Europe, and is in production. In use the unit is normally paralleled with the aircraft battery and the input and output are, respectively, 50-60 c.p.s. current around either 220 or 440 volts, and 28 v D.C. up to 1,000 amp. A quite different line of development, steadily progressing, was the range of Gecalloy micropowder magnets, which are said to be continuously gaining ground over non-sintered magnetic materials.

Among the recent developments by **Sangamo Weston** was a servo potentiometer which, used in conjunction with a chromel/alumel thermocouple array and a Weston indicator with 270 deg scale, can provide really accurate indication of jet-pipe temperature. The company state that this has not hitherto been possible with a long-scale indicator of robust construction. With a few millivolts input, the feedback current from an electronic variable resistance arm of the bridge circuit grows in proportion to the input and can readily be measured. Variations in temperature at the reference junction are allowed for by a temperature-compensating bridge, so that the system is virtually independent of variation in supply voltage, thermocouple plus lead resistance (up to 100 ohms) or reference temperature change, the extreme conditions of a reference junction change of 40 deg C, accompanied by a drop in supply voltage from 28 to 22 causing a maximum of plus or minus one-half per cent of full-scale deflection.

Among many sheet-metal components exhibited by **Sciaky** to demonstrate the sort of work possible with their welding machines were some lap joints in quarter-inch 75ST alloy carried out by the Republic Aviation Corporation. These thick sheets were spot-welded together excellently on a PMCO-6ST-400 machine, there being virtually no distortion or irregularity on either outer surface. Similar welds over the entire surface of thinner sheets by Handley Page had been pulled apart to show the uniform slug-size, and other exhibits were a turbojet propelling nozzle (spot and seam welding) and a lagging assembly (stitch and seam welding).

Self-Priming Pump and Engineering displayed a range of new equipment, much of which was for "unmentionable" aircraft. One of them will benefit by having the SPE 1607 Mk. 1 fuel pump, a complete

NEW DEVELOPMENTS . . .

breakaway from previous practice and with a very neat impeller. This pump, which delivers up to 1,600 gal/hr off a 24-volt system, is available in several forms, the usual mounting being on the side of the tank. The Canberra, originally fitted with the B.P.3 pump, now has Type SPE 1003, capable of delivering no less than 1,000 gal/hr, although it is no larger or heavier—at 11½ lb—than its predecessor. Mounted at the bottom of the tank, and with a standard centrifugal impeller, the pump has increased performance stemming chiefly from an up-rating of the drive motor—which, of course, is of SPE design and manufacture. Under development is a fluid-level switch, which consists simply of a bi-metallic strip mounted on the side of the tank. When the mean fuel level falls below the strip, a continuous electric current heats the strip further than was possible when immersed, and the resulting bending actuates a switch to draw fuel from a different tank. Standard production pumps include those for the Mystère 4—650 gal/hr at 6 lb/sq in, weighing 6.3 lb—and the Gannet, which requires but 350 gal/hr.

Although the main features of **Sperry's** new family of autopilots are completely secret, some details can now be revealed to supplement those given on September 4th. The pilot's neat control-box governs the main units—amplifier unit, altitude control, and hydraulic control—from which hydraulic power is passed to the exceptionally neat servo-motors linked to the aircraft control system—one of which was illustrated last week. The associated flight instrument is an electric horizon gyro. Very high rates of climb and descent can be stabilized by the altitude control and turns up to 70 deg bank can be carried out, hands off, at speeds up to 600 knots indicated. In emergency, the pilot can take out the system by operating a safety trip button on his control column although, as we said on September 4th, any signal tending to give a "hard-over" control movement results in the immediate disengagement of the system. The complete installation, not including the variable weight of cables, oil and other links, weighs 60 lb in the Mk 11 system; Mk 12, with an approach-coupler, is rather heavier.

A new development by **J. Stone and Co. (Deptford)** (whose great range of aircraft rivets was effectively displayed in showcases and by neat production panelling for the Viscount and Varsity) is a flexible coupling, a model of which was hard at work throughout the show. The adjacent ends of the driving and driven shafts each carry a hard rubber tyre, the two tyres being pressed together when the shafts are installed. The friction between the two transmits a useful torque at all speeds without generating excessive heat or causing undue wear. Permissible limits of relative motion between the shafts are, in the size shown: axial, 5/16in; radial, 3/16in; and angular, 4 deg.

Another fabricator of acrylic resins and other plastics, the main exhibit by **Suntex** was a Provost hood, complete with amber screens. An array of welded Perspex tubing, with a wall-thickness up to half-an-inch, showed neat workmanship, and there was also a display of wing tips moulded in clear Perspex. An associated company, Tyneside Safety Glass, displayed an air-sandwich windscreen.

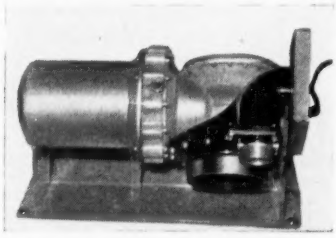
The centre of the **T.K.S. (Aircraft De-icing)** stand was occupied by a section of airliner leading-edge fitted with the company's porous bronze distributor of de-icing fluid, which has every advantage over the type of distributor previously used. A separate leading-edge panel fitting the de-icer area was alongside to show how, by undoing a few screws, an operator might remove the unit in summer, or for short-range low-level flying, with gain in payload. Most significant was the unobtrusive section of porous stainless steel in one corner of the T.K.S. display: development of such material is going on in this country but, where a useful area is wanted, the U.S.A. is the only source at present. Preliminary testing of American 3ft lengths indicates that porous stainless steel is a great improvement over bronze, and is stronger in 0.03in sheet than bronze is in 0.048in. Further, the stainless can be bent to one-eighth inch radius, which should be sufficient for the fastest aerofoil yet contemplated. In America we know that such material is to be used on the Convair F-102 fighter, the de-icing medium being hot air; but T.K.S. remain faithful to their R.328 and other fluids, emphasizing that the freezing point depression so gained is important. Another telling demonstration was a comparison of the compressive strength of ordinary ice at −10 deg C (uncrushable between the fingers) with the complete lack of cohesion of ice mixed with a small percentage of T.K.S. fluid.

The central item on the stand of **Thermo-Plastics** was a complete Hunter canopy blown in half-inch acrylic resin sheet of Perspex type. Although it is difficult to get the optical quality required, this canopy —a standard production job—was as good as any we have seen; it is also, of course, stressed for supersonic flight at the widely varying conditions of temperature and pressure met by the Hunter. A slightly easier job is the Seahawk hood, also on view, which has rather more metal framing. The Seahawk pilots, by the way, wear the standard Royal Navy hard helmet, for which Thermo-Plastics supply Helmets, Ltd., of Wheathampstead, with nylon-impregnated phenolic resin (of which the unit is made) and also the vizor of tinted Perspex.

Many new lines of development were on view at the stand of **Triplex** safety glass. One exhibit was a specimen heated panel embodying a grid of 0.0008in nichrome wires, spaced parallel eighty to the inch, the heating current being applied across copper busbars at the ends of the wires. To overcome the slight hindrance to vision which the wires cause—particularly the odd blue glint experienced in certain conditions —the company have developed a gold-film heating method, to be marketed as Triplex GF. It is quite new to this country and, with it, rainbow effects or vision interference are completely absent. In fact, Triplex say "this is the answer." The film of gold and an unspecified metal oxide is deposited with a uniform thickness of 0.0000002in (50 Angström units)under the first glass lamination, of some 3/16in. Power can be applied across the film at an intensity of between 750 and 1,000 watts per square foot. Although GF is still principally a laboratory development, Triplex believe that with it they have surpassed the American NESA corporation, who pioneered the technology.

Supplementing the famous **Venner** range of lightweight accumulators were a number of magnetic relays having a number of aircraft applications. Double-pole, two-way, 25 amp contacts or four-pole, two-way, 10 amp contacts are available, all the relays operating off a 24 v direct-current supply. The units appeared to be exceptionally neat, and they can be supplied in cases of aluminium or moulded plastic.

A very attractive dark green plastic on the stand of **Wallington Weston** proved to be FromoPLAS, a quite remarkable material. Supplied as a chip moulding powder, FromoPLAS is possibly the strongest plastic available anywhere. With a tensile strength approximating to that of cold-rolled aluminium, it is less than half as dense (S.G. = 1.24) and shows a remarkable range of good properties. Examples were shown of sheet after the passage of 0.303in bullets, or the arresting of a 9mm projectile and the deflection of a 0.22 pellet, all fired at 90 deg from 25yd; the material was in no case seriously affected, and all that was visible was a small hole or depression, almost completely sealed up by the material's "self-sealing" property. Some properties are: tensile, 10,000 lb/sq in; shear, 18,000 lb/sq in; Izod (half-inch-square notched bar), 14-16 ft-lb; elongation, 15-20 per cent at break. From PLAS can be moulded, machined, welded, and bonded to itself and to metals.



Soon to feed supersonic power: S.P.E. pump Type 1607, which incorporates several new features. It can pass over 1,600 gal/hr. (Self-Priming Pump and Engineering Co., Ltd.)

Although **Western Manufacturing (Reading)** are best known as producers of electric equipment, they are now developing a range of pneumatic actuators in order to overcome the temperature limitations inherent in D.C. motors. The Type ARJ.55 Mk 1 actuator shown was capable of operating over the range −55 deg C to +200 deg C; driven by a simple irreversible motor taking air at from 10 to 300 lb/sq in—compressor bleed air, for example—the rotary drive over 180-deg range offered a maximum torque of 100 lb-in, the full movement taking 15 seconds against a load of 55 lb-in. This performance was substantially independent of supply pressure, the control being effected by solenoid-operated valves and electric limit switches working off a 24 v supply. Total weight was 6 lb 6 oz.

Almost every country makes use of the Nimonic alloys developed by Mond Nickel and fabricated by **Henry Wiggin.** The latest alloys of which details may be given are Nimonic 90—containing a proportion of cobalt and having creep properties such that it may be used between 800 and 870 deg C—and Nimonic 95, the latest alloy in use and a general improvement over "90." The well-known flame-tube material, Nimonic 75 sheet, has now been modified into Nimonic F, the new alloy having a higher iron content. The resistance to oxydation of the new alloy is very good and it is accepted as the equivalent of "75" for flame tubes and other hot parts. Of great consequence is the new Nimoply, a sandwich of heat-conducting copper between two sheets of Nimonic 75. When all the production problems have been solved Nimoply is certain to be of great value in gas turbines.

S.B.A.C. OFFICERS, 1953-54

OFFICERS of the Society of British Aircraft Constructors for 1953-54, together with the constitution of the council and the management committee, and chairmen of other committees, are announced by the Society as below. Where there has been a change or addition in relation to the 1952-53 appointments, the new name appears in *italics*.

Council

President: H. Burroughes. **Deputy-President:** W. T. Gill. **Vice-President:** J. J. Parkes. **Treasurer:** Sir Frederick Handley Page, C.B.E.

Members: F. Bates; R. Blackburn, O.B.E.; A. F. Burke, O.B.E; H. T. Chapman, C.B.E.; Capt. E. D. Clarke, M.C.; Sir Roy Dobson, C.B.E., J.P.; T. Gammon, O.B.E.; D. F. McIntyre; J. Martin, O.B.E.; Sir George Nelson; H. G. Nelson; J. D. North; W. E. W. Petter, C.B.E.; *G. C. D. Russell;* F. E. N. St. Barbe; Rear Admiral M. S. Slattery, C.B.; Sir Reginald Verdon Smith, J.P.; Sir Frank Spencer Spriggs, K.B.E.; *Sir Ralph Sorley, K.C.B., O.B.E., D.S.C.;* W. A. Summers; C. F. Uwins, O.B.E.; Sir Norman Watson, Bt.; E. C. Wheeldon; H. M. Woodhams, C.B.E.; Major M. E. A. Wright, A.F.C.; *R. P. H. Yapp.*

Group A associate members' representatives: *G. W. Lacey, C.B.E.*; Major E. I. Scott, M.C.

Group B associate members' representatives: L. A. Morgan; E. Sayers; S. W. Hughes.

Management Committee

H. Burroughes, R. Blackburn, A. F. Burke, H. T. Chapman, Capt. E. D. Clarke, Sir Roy Dobson, *T. Gammon*, W. T. Gill, H. G. Nelson, J. D. North, Sir Frederick Handley Page, J. J. Parkes, F. E. N. St. Barbe, Sir Reginald Verdon Smith, Sir Frank Spencer Spriggs.

Group A representative: *G. W. Lacey.*

Group B representatives: L. A. Morgan, E. Sayers.

Committee chairmen: Sales and Export, F. E. N. St. Barbe; Contracts advisory, A. S. Kennedy; Group A associate menber, *G. W. Lacey;* Group B associate member, L. A. Morgan; Test Pilots, C. F. Uwins; Technical board and technical executive, *R. S. Stafford.*

CIVIL AVIATION

GOOD WINE: One of the most unforgettable sights at the recent Farnborough Display was the final event—a slow, majestic fly-past by the Saunders-Roe Princess. The great boat is seen just before climbing away from the airfield into an evening sky, with retraction of wing-tip floats almost completed.

F.I.T.A.P. APPOINTMENTS

AS reported in the previous issue, Mr. L. G. Braathen was elected 1953 president of the International Federation of Independent Air Transport Operators, whose annual assembly was held recently in London. Additional appointments for the coming year were those of Col. J. Pazo-Montes (Aviacion y Commercio) and M. Paul Bernard (T.A.I.) as vice-presidents. Gen. R. Bonneau was re-elected treasurer, and M. Jean-Marie Riche continues as secretary-general of F.I.T.A.P. Barcelona has been chosen as the scene of the next meeting, to be held on December 11th, of the association's management committee.

INDIAN AIR NEWS

SOME of the findings of the committee appointed to study the training of civil pilots in India have now been published. In the first place, it is recommended that a civil air board should be set up to advise the Communications Ministry on policy matters, to control clubs' subsidies, to lay down training conditions and to issue licences. The committee urged that the existing "A" and "B" licences should soon be replaced by the wider range of licences now issued in Britain. Clubs, it is suggested, should have 3,500-4,500 subsidized flying hours annually, and should only receive subsidies for training pupils to P.P.L. standard. All commercial pilots, said the committee, should be trained at the Civil Aviation Training Centre, Allahabad. The annual commercial-pilot requirement was estimated at 30, of which 15 should be ex-I.A.F. pilots (India has at present 531 pilots holding "B" licences). The proposed flying syllabus for *ab initio* pupils trained at Allahabad is 225-250 hr on Chipmunks, 30 hr on Ansons and 30 hr on Dakotas.

Discussions between Indian and U.S. delegates on the proposed revision of the bilateral agreement between the two countries are reported to have broken down. India initiated the talks last May in an attempt to reduce the amount of fifth-freedom traffic carried to and from India by American aircraft.

Several improvements are being made at the Indian international airport of Santa Cruz, Bombay. At a cost of £37,500, I.L.S. equipment is being imported from America and will be installed early next year; a new terminal building will also be completed in 1954; and a £75,000 scheme for new lighting on the main east-west runway has been approved. A recent survey of bad-weather alternatives to Santa Cruz found that the most suitable airfields available were those at Ahmedabad, 300 miles to the north, and at Poona.

AFRICAN MINERS' AIRLIFT

IN his annual report for 1952, the Director of Civil Aviation in Nyasaland, Mr. H. M. Johnston, says that one of the outstanding events was the continued and increasing success of the operations of the charter company which carries African labour for the Rand mines to and from Nyasaland. He states that the airlift is significant, not only because it is an entirely new medium of transport for African labour, but because of the operational problems involved. Fully half the 700 miles flown eight times weekly between Lilongure, Central Province, and Francistown, Bechuanaland, is uncleared bush, and except for the southern portion of the route, radio aids to navigation are limited to H/F radio-telephone and non-directional M/F beacons. Plans are under way to improve these facilities.

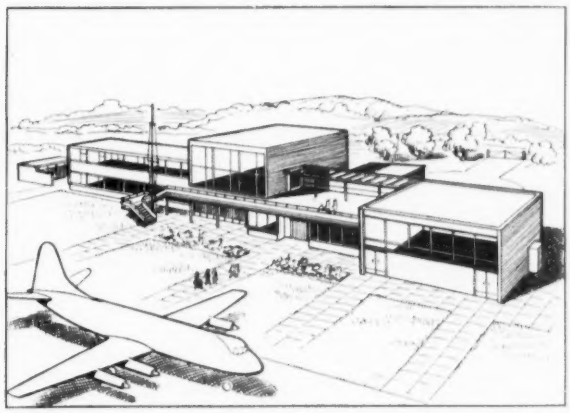
A South African correspondent reports that the charter company concerned, Africair, Ltd., of Johannesburg, whose operations have until recently been carried out with two Dakotas, has acquired two more in England. A director, "Tommy" Mitchell, who arrived back in Johannesburg recently with the first of these aircraft, said that they would be stripped and overhauled for the opening up of the new route involving South-west Africa. The success of the airlift of native mine-workers has been amply proved during recent years, and it is probable that the company will later acquire a number of Skymasters.

ATHLETES AND ARGONAUTS

ALTHOUGH there are still occasional cases of reluctance among controlling authorities to use the swifter form of travel, the value of air transport as a means of facilitating international sport is now widely appreciated throughout Europe. Competitors not only save time *en route*, but usually feel fresher on arrival. An example is provided by the following account from a member of the British Amateur Athletic Board who acted as track judge at recent Berlin and Stockholm meetings:—

"Twice within the last twelve months B.O.A.C. has laid on a special charter service which has enabled a team of over 40 British athletes and officials to carry through important inter-

SCOTS CENTRES of air travel are the airports of Turnhouse (Edinburgh) and Renfrew (Glasgow), whose new terminal buildings are illustrated below. At Renfrew (right) work on the reinforced concrete structure is nearing completion, and the building will come into use in next year's summer season. Plans for the Turnhouse building have just been approved; it is hoped that construction will begin this year and will be completed by 1955.



PATHFINDER for production versions of the Comet 2, due to enter service on B.O.A.C.'s South American route next year, the Avon-powered Comet 2X is pictured at Galeao, Rio de Janeiro, after its recent flight from London. With Sir Miles Thomas aboard, it returned to L.A.P. on Saturday, having crossed from Rio to Madrid via Natal (Brazil), Dakar and Casablanca in 12 hr 45 min flying time; the 814-miles journey from Madrid to London took 1 hr 55 min.

CIVIL AVIATION . . .

national matches. On both occasions an Argonaut was used, flown by Capt. R. Ballantine, M.V.O., assisted by 1st Off. R. C. Lake, D.F.C., Nav. Off. A. Shelton, Rad. Off. J. Robbie, Stewards A. Forbes and A. Maclean and Stewardess T. Barzilay.

"*Ajax* took off from London Airport at midday on August 29th and the party arrived at Berlin 2½ hr later, enabling the team to be practising by 4.30 on one of the new German tracks. On this occasion circumstances demanded the immediate return to London of *Ajax* and crew. *Aurora*, flown by the same crew, left London at 4.15 a.m. the following Monday to resume the trip to Stockholm. Taking off at 2.30 p.m., the team arrived at 5.40 and were in their quarters, 9 km from the airport, an hour later."

REDUCED PROFIT FOR B.O.A.C.

PUBLISHED on Tuesday, the B.O.A.C. report for the financial year ended March 31st, 1953, shows that increased revenue was insufficient to offset generally rising costs and such setbacks as the fuel crisis last year, a spell of unusually severe winter weather, temporary grounding of the Stratocruiser fleet and a drop in U.K.-Australia mail traffic. The result was a greatly reduced operating profit—£103,875, compared with £1,233,722 in 1951-52. Last year there was a surplus of £274,999 after payment of interest on issued capital; this year a deficiency of £292,718 is carried forward. No grant has been claimed from the Exchequer, and B.O.A.C. point out that operations were carried at no cost to the taxpayer.

The Corporation's financial and operational results for the two financial years are summarized below:

	1951-52	1952-53
Profit (before payment of interest on capital)	£1,233,722	£103,875
Grant from Exchequer	£1,500,000	—
Capital and other surpluses	£643,437	£545,946
Interest paid on issued capital	£958,723	£942,539
Variation in accumulated deficiency	£2,418,436	+ £292,718
Total revenue	£33,567,862	£36,156,579
Capacity ton-miles flown	194,536,807	214,555,753
Cost (pence per c.t.m.)	38.8	40.1
Revenue per employee per annum	£2,047	£2,093
Revenue hours flown	141,429	147,469
Passengers carried	250,173	290,629
Freight carried (short tons)	6,031	5,630
Mail carried (short tons)	2,895	3,110
Load factor	65.7 per cent	64.5 per cent
Break-even load factor	65 per cent	66 per cent

At the end of the period reviewed, the fleet consisted of eight Comets, 22 Argonauts, 10 Stratocruisers, 12 Constellations, nine Hermes and six Yorks. Delivery of 12 Comet 2s will begin shortly (the first machine is now flying) and the Corporation expects to have three Britannia 100s engaged in training and route-flying next year. The first operational Britannia, with C. of A. for passenger-carrying, should be ready for service in the early months of 1955.

It has also been suggested by B.O.A.C. that the Exchequer should contribute towards the cost (on a flying-hour basis) of developing and proving Britain's new aircraft.

Referring to the adverse conditions which affected this year's balance sheet, Sir Miles Thomas agrees that "all these are the normal hazards of an international commercial organization." He adds, however, that "we are also faced with difficulties peculiar to our position as the Government instrument for the operation of long-range British international services. As such, we have always recognized our special responsibility to employ British manufactured aircraft . . . this expenditure is undoubtedly one of the factors which has adversely affected our financial results in recent years. If we incur commensurate expenditure in introducing into service the aircraft we now have on order, which are larger and more costly than earlier types, our financial results in the years immediately ahead will be even more seriously affected—a state of affairs which cannot be contemplated."

Sir Miles went on to say that business during the present financial year had been good so far, but he added that it would be unwise to expect any spectacular improvements this year or, in fact, until fleets of more advanced Comets and Britannias were in service.

SUBJECT TO CONFIRMATION

A STATEMENT for or against the Comet appears to have become the airline executive's standard method of attracting the headlines. Last week, for example, the following remark was attributed to Mr. G. T. Baker, president of National Airlines: "When America's airlines are ready for jets, the superior production methods of our manufacturers will enable us to catch the British in a hurry." This view is apparently not shared by Mr. R. E. Wieland, New York vice-president of the same company, who spent last week with de Havillands at Hatfield. Before leaving London Airport on Sunday night, Mr. Wieland said, according to reports, "The Comet is a tremendous aeroplane . . . If we can make the right terms and get the right delivery dates the deal should go through. There would be an initial order for three, followed by another one for nine more Comets." He added that "it seems the dates would suit us."

Inevitably, Mr. Wieland's remarks recall the similar sentiments expressed about a year ago by Capt. Rickenbacker of Eastern Air Lines—National's main competitor on the lucrative New York/Miami route. To compete with Eastern's Super Constellations, National have bought eight DC-6Bs, supplementing the seven DC-6s which have been in service on the long-haul routes since 1947-48. In addition, the company has ordered four DC-7s—the latest piston-engined airliners available—for delivery in 1954, and eight Convair 340s. National are thus seen to be committed to a costly re-equipment programme; depreciation of the new aircraft will not be completed until 1957-58. Unless it had increased its network or previously disposed of some of its piston-engined equipment, the airline would be unlikely to embark on a jet-airliner programme before that date.

National's intention (assuming Mr. Wieland is not "pulling a Rickenbacker") would presumably be to start operations in about two years' time with a small batch of Comet 2s, and to follow up with an order for nine Comet 3s—which will, in fact, be available by 1957.

The following day, de Havilland confirmed that Mr. Wieland has visited Hatfield, but expressed polite surprise at the contents of his subsequent statement to the Press, adding that their negotiations with National Airlines were no more advanced than those with several other operators. Our own reaction is to treat such statements with reserve, pending the manufacturer's announcement that a contract has actually been signed.

The aeroplane

The Princess. The heaviest flying boat in the air with a length of 150 and span of 220 ft. Its 14,500 gallon tanks and ten Bristol Proteus engines give it a still air range of 5,000 miles.

The pilot

Geoffrey Tyson. Started to amass flying total of 6,200 hours by joining R.A.F. in 1925. After spell with Short Bros. as Chief Test Pilot, moved to Saunders-Roe in 1946 where he now draws on experience gained in over 200 different types of aircraft. Of the Shell and BP Aviation Service, he says " I can't remember when the Shell and BP Aviation Service wasn't there to lend a hand."

SHELL and BP Aviation Service

The Shell and BP Aviation Service must be one of the most democratic institutions in the world. For, where fuelling is concerned, it's ' fair shares for all ' from the noblest Princess down to the smallest Auster. It would be difficult, too, to find a better example of fair distribution. Touch down at any of Britain's major airfields and you'll see the familiar refuelling vehicle ready to go into action.

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Distributors in the United Kingdom for the Shell and Anglo-Iranian Oil Groups.

THE SAUNDERS-ROE **'PRINCESS'**

Another aristocrat of the air using

'Bostik' *in its construction*

It was 'BOSTIK' Adhesives and Sealing Compounds that really made cabin aircraft construction possible. It did this by making cabins wind and watertight—first time and all the time. That was in 1934 and a year later, the Saunders-Roe Company put its trust in 'BOSTIK' by using it in the construction of the "Saro London". That trust has never wavered, and we are indeed proud to place on record the fact that in the construction of the mighty Saunders-Roe Flying Boat—"Princess" 'BOSTIK' has been used. You will find 'BOSTIK' sealants being used in the most modern aircraft of which the "Princess" is typical.

✻ *"BOSTIK" Sealing Compounds No. 1751, 1752, and 1790 were used for sealing pressurized cabins and for sealing integral fuel tanks.*

'Bostik'

ADHESIVES AND SEALING COMPOUNDS

in the daily service of Britain's aircraft industry since 1934.

'BOSTIK' is the registered trade mark of the
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AIRCRAFT INTELLIGENCE

STRETCHED NEPTUNE: Current production Lockheed P2V-6s feature this new tail-end fuselage section housing search radar. The tail is an unusual location for such equipment; the only similar installation we can call to mind is that on some Douglas B-18E Bolo bombers in 1942.

U.S.A.

Kellett Convertiplane. A Kellett autogiro (which was used on a scheduled air-mail service by Eastern Air Lines in 1939) is being modified by the makers for convertiplane experiments. Kellett have a Navy contract, which calls for the addition of a small wing on each side carrying a 140 h.p. Lycoming engine, and a new rotor drive. The original 225 h.p. Jacobs radial will be retained. The completed aircraft may be unique, in that it will have three engines of two different types.

Lockheed RC-121C and WV-2. These designations are used, respectively, by the U.S.A.F. and U.S. Navy for "flying radar station" versions of the Super Constellation now in production. A Lockheed announcement states that the WV-2s "will be able to fly from land bases to points far at sea where they can patrol for long periods guarding Navy contingents from surprise attack, in any waters of the world." The WV-2s will be equipped to serve also for the direction of carrier-borne fighters. An 8ft-high structure protruding from the top of the fuselage houses the height-finding antenna, and the huge bowl-shaped radome beneath the fuselage is described as "probably the largest plastic part ever built." The crew can number up to 31, including relief pilots and radar officers. Despite the huge excrescences, the maximum cruising speed approaches 335 m.p.h.

Republic Production. The main effort at Farmingdale is centred upon the F-84F and RF-84F Thunderstreak. This is in full production for the U.S.A.F. and various N.A.T.O. air forces. The last straight-wing Thunderjet was delivered two months ago. In all, 4,457 were built. Soon to come are the F-103, F-105 and their reconnaissance variants, all of which are the subjects of big production contracts. The "103" is an inverse-taper fighter developed from the XF-91 Thundercepter Unusually small, it will be supersonic in level flight, with rockets and a large turbojet; much titanium is used in the airframe. The much bigger "105" is a delta-wing aircraft, capable of use in fighter, attack, photographic or bombing roles.

Argentina

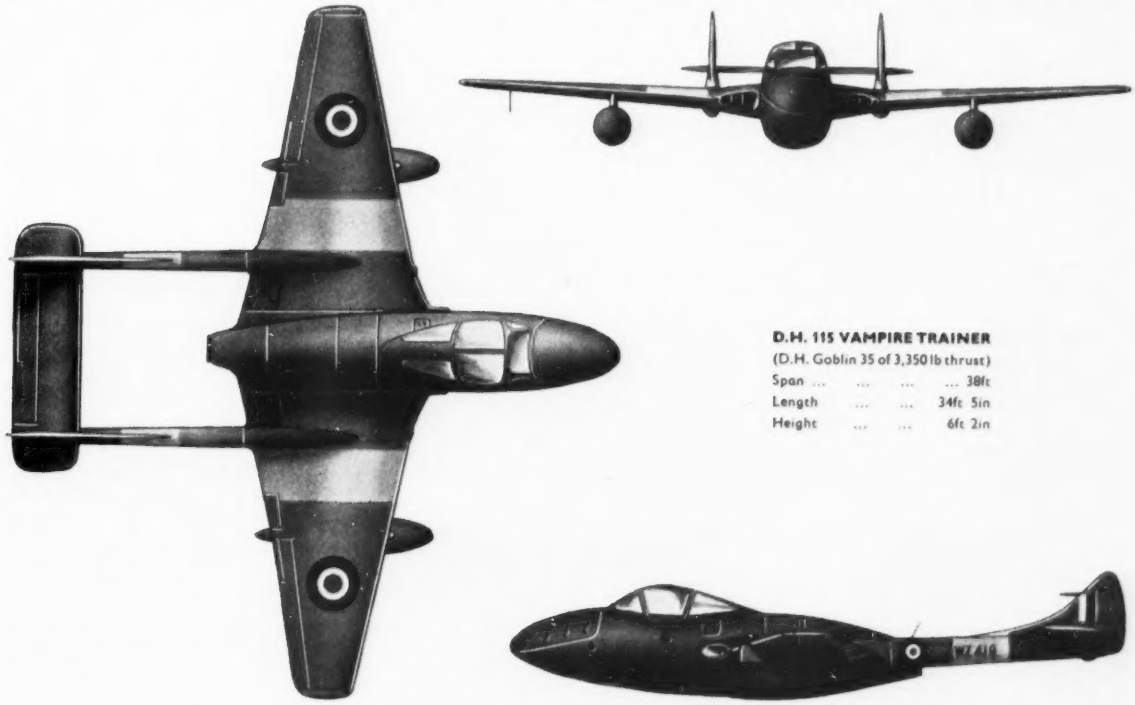
Instituto Aerotecnico Types. The I.Ae.35 is announced as an all-metal twin-engined machine designed to replace the numerous Beechcrafts now serving with the Argentine Air Force. It is suitable for air survey, reconnaissance or ambulance work, and is powered with two 650 h.p. engines built, like the airframe, at Cordoba. Top speed is about 225 m.p.h. and range about 1,000 miles. Other news from the Argentine concerns the I.Ae.43, an 18-passenger civil transport with a top speed of 230 m.p.h. and a cruising speed of 185 m.p.h. The fuselage is of plywood.

Spain

Bell Helicopters. The Spanish Navy is reported to have ordered three Bell helicopters and to be negotiating for a further nine. Ten different manufacturers submitted competitive bids.

Holland

De Schelde-built Saab Safir. The total of Saab-91B Safir trainers ordered by the Swedish Air Force from the de Schelde works near Dordrecht, Holland, is 120. Because the Saab concern has transferred Safir production complete to De Schelde, all further orders for this type will be executed by the Dutch firm. Eight more Safirs have been delivered to Sabena for pilot training, and it is thought that a number have been ordered by the Indonesian Government for a civil pilot school. The prototype of the Saab-91C, a new four-seat tourer version, will shortly be ready.



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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

"Flight" photograph

BATTLE OF BRITAIN FLY-PAST: One of the Meteor formations passes over the Royal Air Force Memorial on the Thames Embankment.

The Battle of Britain Service

WESTMINSTER Abbey having been closed since the Coronation, the Thanksgiving Service for victory in the Battle of Britain was held in St. Paul's Cathedral.

The Queen was represented by Air Chief Marshal Sir John Baker, Vice-Chief of the Air Staff, and among many other high-ranking officers present were Air Chief Marshal Sir William Dickson, Chief of the Air Staff, and Lord Dowding, A.O.C.-in-C. Fighter Command in 1940.

Canon L. J. Collins, who conducted the service, is the Chancellor of St. Paul's and was at one time a chaplain in the R.A.F. The Ensign was carried to the High Altar by W/C. P. Simpson, a Battle of Britain pilot.

A service was also held at St. George's Memorial Chapel, Biggin Hill, at which representatives of squadrons stationed there in 1940 and bereaved relatives took part.

The Duke at Ford

H.R.H. the Duke of Edinburgh is to pay a visit to the Royal Naval Air Station at Ford, Sussex, on Friday, October 23rd.

R.A.F. Appointments

HITHERTO Director of Operations (2) at Air Ministry, A.Cdre. D. N. Roberts, O.B.E., A.F.C., has been appointed Senior Air Liaison Officer on the United Kingdom Service Liaison Staff in Canada, from October. He will be succeeded by G/C. N. C. Hyde, C.B.E., who, as commander of R.A.F. Station, Binbrook, led the Canberra units in the Queen's birthday and R.A.F. Review flypasts. G/C. Hyde will receive the acting rank of Air Commodore.

In succession to A.Cdre. J. Warburton, who is retiring from the Service, A.Cdre. R. L. Kippenberger, C.B.E., has been appointed A.O.C. No. 64 (Northern) Group, Home Command. Born in New Zealand in 1907, A.Cdre. Kippenberger has, during the last 16 months, served in the organization branch of H.Q. Fighter Command. During the previous two years he commanded R.A.F. Station, Upwood.

Third and First

THE Squadron Standard will be presented to No. 7 Bomber Squadron at R.A.F. Upwood on October 9th by Marshal of the Royal Air Force Sir John Salmond, G.C.B., C.M.G., C.V.O., D.S.O., the Squadron's first commander. No. 7 Squadron will be the first bomber squadron to receive its Standard, and the third squadron in the R.A.F. to do so. Nos. 1 and 600 (City of London) Squadrons were the first to receive Standards.

"Bobbie" Yule

IT is with regret that we record the death of W/C. R. D. Yule, D.S.O., D.F.C. and Bar, in a flying accident while practising for the Battle of Britain fly-past. He was 31 years of age.

W/C. Yule was outstanding both in personality and as a pilot. He fought in the Battle of Britain and was given command of No. 66 Squadron at a very early stage in his career. At the time of his death he was Wing Commander Flying at Horsham St. Faith.

R.Aux.A.F. Appointments

TWO recent R.Aux.A.F. appointments announced by the Air Ministry are those of W/C. E. B. R. Lockwood, D.S.O., M.B.E., to command No. 3508 (County of Northumberland) Fighter Control Unit and S/L. J. A. Stephen to command No. 607 (County of Durham) Squadron.

W/C. Lockwood served for a while during the war in the capacity of an instructor but later, in the Middle East, he became a flight commander with No. 614 (County of Glamorgan) Aux.A.F. His D.S.O. was awarded for outstanding leadership and successfully directing six major attacks against well-defended targets.

S/L. Stephen entered the R.A.F. as an apprentice in 1936 and was commissioned in the General Duties Branch in 1944. He has served with No. 137 Squadron in B.A.F.O. and in April last year became a flight commander of No. 19 Squadron.

Laurence Minot Trophy

BOMBER COMMAND'S visual night bombing competition for the Laurence Minot Trophy was due to take place on the nights of September 21st and 22nd. Two crews from each of 20 squadrons were to make 800-mile flights to bomb the ranges at Nordhorn in Germany, and two of the ranges at Wainfleet, Lincs, Berners Heath, Suffolk, or Otmoor, near Bicester. Two U.S.A.F. B-50 crews have accepted an invitation to take part. More than half the bombers competing this year will be Canberras.

Remembering Arnhem

A MEMORIAL to members of the British forces who died in the liberation of the Netherlands in 1944-45 was unveiled in Arnhem by Queen Juliana of the Netherlands on September 17th. Among those present at the ceremony was Maj. Gen. R. E. Urquart, commander of the 1st British Airborne Division in September, 1944. After the ceremony a procession visited the area around the Rhine bridge where the airborne action was fought. At the same time 1,200 men of the 44th Parachute Brigade (TA) were dropped with their equipment in the Stanford battle area in Norfolk; part of exercise "Kings Joker II," their jump commemorated the Arnhem action of which many of the men were veterans.

Reunion

THE sixth annual reunion of No. 166 Squadron will be held in London on October 17th. Information and tickets, price 12s, from F. C. Tighe, 31 Mayo Road, Sherwood Rise, Nottingham.

FROM TWO WARS: Watching the Battle of Britain fly-past from the roof of the Air Ministry are, left to right: Lady Dowding and Air Chief Marshal Lord Dowding and Marshals of the Royal Air Force Lord Trenchard and Sir John M. Salmond.

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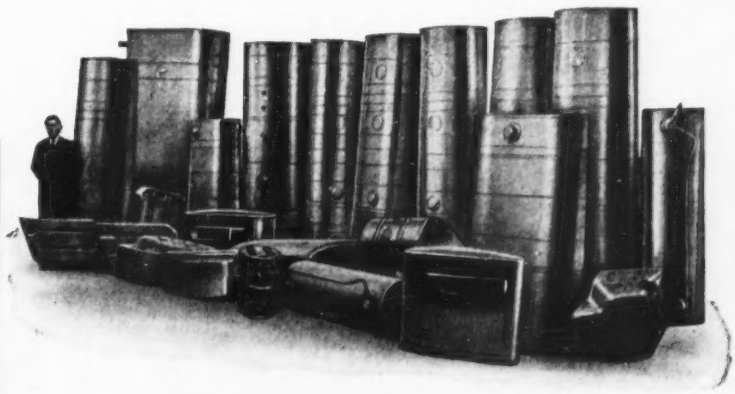

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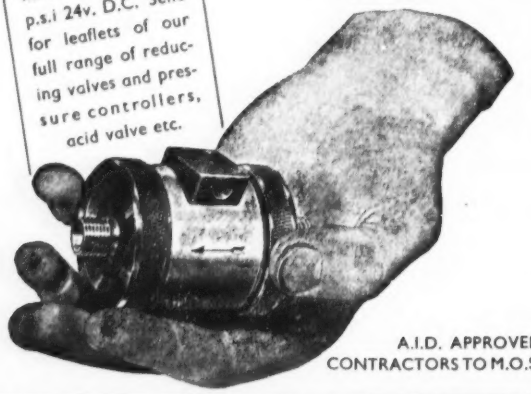

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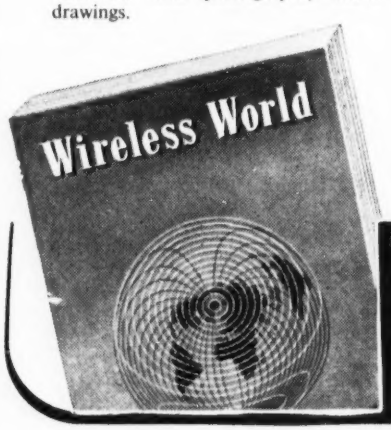

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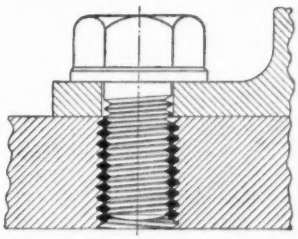

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate Scheduled Air Services:—

Application No. 180 (Revised). From Transair Ltd. of Croydon Airport, Surrey, for a Seasonal Inclusive Tour service with Dakota aircraft for the carriage of passengers and supplementary freight between London (Gatwick) and Rijeka (Yugoslavia) with an intermediate traffic stop at Ljubljana, at a frequency of one service weekly during the season from May to September for a period of seven years, commencing May 15th 1954.

Application No. 41/2. From Airlines (Jersey) Ltd., of 4, The Parade, St. Helier, Jersey, C.I., for permission to operate certain of their frequencies on their Normal Scheduled Service on the Manchester, Coventry, Bournemouth, Guernsey, Jersey, Dinard, Rennes and La Baule route (Application No. 41), recently approved by the Minister of Civil Aviation, as a service between Bournemouth and Guernsey/Jersey only.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [1058

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SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provision of The Notification of Vacancies Order 1952.

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D. NAPIER AND SON, Ltd., Acton, W.3, wish to appoint a senior designer. The candidate must be well qualified and have really extensive experience on aero gas turbine design. Write in confidence to Dept. C.P.S., 336, Strand, W.C.2, quoting ref. 893. [1064

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THE Aircraft Division of The English Electric Co., Ltd., Warton Aerodrome, nr. Blackpool, require a wind tunnel technician for work on low speed and supersonic wind tunnels. Candidates should have a degree in engineering, physics or mathematics, or the equivalent. Please apply, quoting ref. 1174 to Dept. C.P.S., 336/7 Strand, W.C.2. [1060

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H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

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REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds, several draughtsmen with comprehensive experience of engine installation and allied systems. Good welfare facilities, including staff pension scheme.—Applications in writing, stating age, qualifications, experience and salary required, to the Personnel Manager. [0601

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EXPERIENCED technical illustrators, authors and spares schedule compilers required for the preparation of aircraft maintenance manuals, etc. Good wages and permanent posts for suitable men. Applications in writing should state age, experience and wage expected and be addressed to the Chief Designer, Auster Aircraft Ltd., Rearsby Aerodrome, Leicester. [1073

ARMSTRONG SIDDELEY MOTORS have vacancies for technical assistants for research and experimental work on aircraft gas turbines; particularly on compressors, turbines and aerodynamic flow problems. Engineering Degree, H.N.C. or equivalent necessary.—Write in detail to Reference A1, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1074

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable. Good welfare facilities including staff pension scheme.—Applications, stating qualifications, experience, age and salary required, to Personnel Manager. [0596

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen and stressmen for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [0595

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MINISTRY OF SUPPLY, R.A.E., Farnborough, Hants., requires engineers to assist in investigations and development work on installation of armament equipment in aircraft. Minimum qualification—Higher School Certificate (Science) or equivalent, but degree or H.N.C. in Engineering may be an advantage. Experience of experimental work using electronic recording techniques essential. Salary within ranges: Experimental officer (min. age 26), £649-£799, or assistant experimental officer, £264 (age 18)—£576. Women somewhat less. Appointments unestablished. Application forms from M. L. and N. S., Technical and Scientific Register (K), 26 King Street, London S.W.1, quoting D354/53A. Closing date, October 10th, 1953. [1059

CITY OF MANCHESTER, Airport Manager, Ringway Airport. Applications for this whole-time, superannuable post are invited from candidates who have had previous experience in aerodrome management and control and possess wide administrative and organizing ability. The salary will be in accordance with J.N.C., Grade G (£1,500 by £50 to £1,750 per annum), or Grade H (£1,650 by £50 to £1,900 per annum) according to the ability, experience and qualifications of the selected candidate. Particulars of the appointment and forms of application can be obtained from the Town Clerk, Town Hall, Manchester 2, to whom all applications, endorsed "Airport Manager," should be delivered not later than October 23rd, 1953. Canvassing is prohibited. Previous applicants need not apply. [1080

SITUATIONS WANTED

PILOT, A.L.T.P., inst. rat., R/T licence, 6,000 hours, command York, Dakota, Consul, Viking. Free after September.—Box 0592. [1052

LINK instructor, 28, P.P.L., R/T, 3,000 hours. 550 pilot singles, twins, flight test observer; seeks employment home or abroad.—Box 0711. [1076

EX-SERVICE pilot (25) C.P.L. R/T licences. 970 hrs. mostly twins and multis. Seeks permanent or temporary post. Anything considered.—Box 0710. [1071

PILOT, senior commercial, 5,200 hours, 3,300 hours Dakota, requires full or part-time position or free-lancing.—Box 0699. [1068

EXPERIENCED personnel officer, aviation and industrial background, seeks post in U.K.—Box 0467. [1034

ENGINEER, licensed all light aircraft, Rapides, Anson "A" and "B", all light engines "C." Over 20 years' experience England and overseas.—Box 0700. [1069

EXECUTIVE engineer, aged 39-40, specialist aircraft pressurization, air conditioning, embracing air turbines and heat transfer, also aircraft electrical equipment. Experienced technician, designer, organizer and administrator, able to negotiate at all levels. Widely travelled overseas, extensive contacts airlines, ministries, Services and aircraft industry. Now engaged managerial position, but requires change. Preferably sales, liaison or technical.—Write, British Monomark, BM/Airmatic, London W.1. [1037

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Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

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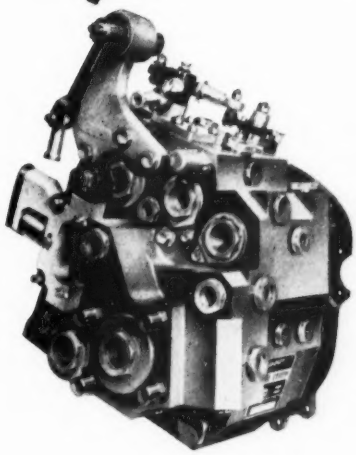

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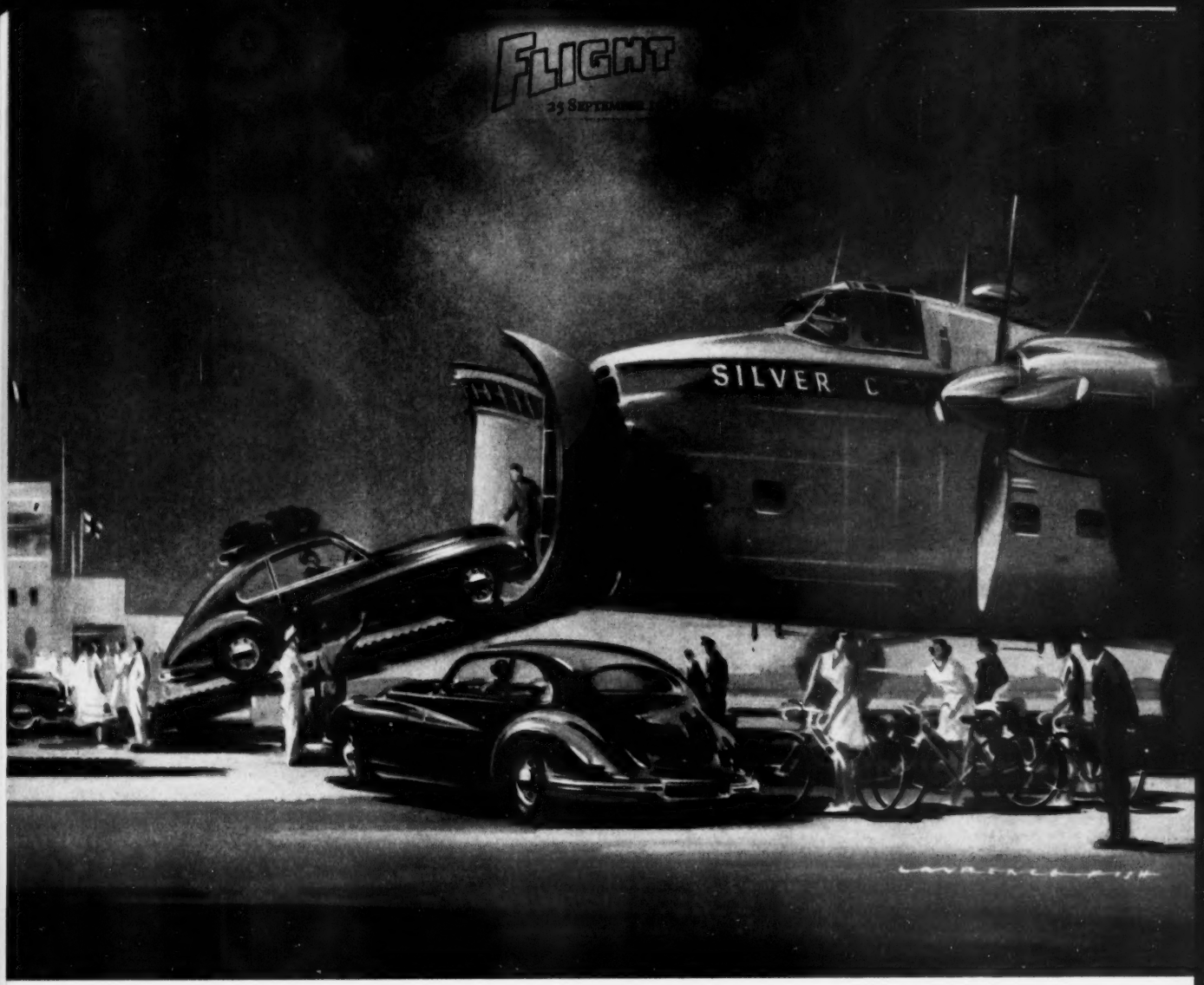

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